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LA VEGETACION DE NUEVA GALICIA

by

JERZY RZEDOWSKI

Escuela Nacional de Ciencias Biológicas

México, D.F.

and

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University of Michigan

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Vista panorámica de la Península de Santiago, cerca de Manzanillo. El bosque tropical subdeciduo cubre las laderas de los cerros practicamente hasta el nivel de la marea alta. Los manchones más obscuros en la parte plana corresponden a vestigios del palmar de *Orbignya*. En el fondo, a distancia de unos 50 km, pueden observarse altas montañas del sur de Jalisco. (Fot. num. 10037, Cía. Mexicana Aerofoto, S. A. Reproducción autorizada).

INTRODUCCION

Dentro del territorio de la República Mexicana, la porción occidental cuenta entre las menos conocidas en cuanto a su flora y vegetación. Uno de nosotros (McVaugh) ha iniciado desde 1949 una exploración intensiva del estado de Jalisco y de áreas adyacentes, teniendo como meta la preparación de la flora de la región en una época considerada como Nueva Galicia. El resultado de esta actividad ha sido la recolección de cerca de 60,000 ejemplares de herbario. La revisión de diversos grupos taxonómicos se encuentra en desarrollo.

La presente contribución se refiere exclusivamente a la vegetación de la zona y sus relaciones con el medio; fue realizada con la idea de ser incluida como capítulo introductorio a la flora. Hemos considerado conveniente publicarla por separado en forma preliminar, con el objeto de ponerla a prueba y a la crítica de todas las personas cuyas actividades pudieran estar relacionadas con la vegetación y con la ecología de esta región, así como con el propósito de emplear los nombres de los tipos de vegetación y de otras comunidades vegetales aquí descritas como referencia en trabajos taxonómico-florísticos que están en preparación.

Una parte del trabajo de campo así como varias fases del estudio realizado en México, en Ann Arbor y en otros sitios han sido subvencionadas a través de subsidios obtenidos de Horace H. Rackham School of Graduate Studies, University of Michigan, y de National Science Foundation, Washington, D.C.

El primero de los autores inició la preparación de este estudio mientras laboraba para el Colegio de Post-Graduados de la Escuela Nacional de Agricultura, de Chapingo, Méx. La confección de varios de los mapas se debe a Graciela C. de Rzedowski. La mayor parte del costo de la publicación del trabajo fue sufragada por National Science Foundation.

Los autores agradecen a los directivos del Plan Lerma, del Consejo de Recursos Naturales No Renovables y de la Comisión de la Costa de Jalisco, el haber permitido la consulta de fotografías aéreas conservadas en sus archivos.

ANTECEDENTES

La vegetación de Nueva Galicia ha recibido hasta ahora tan poca atención por parte de los botánicos, que sobre los estados de Jalisco, Nayarit, Aguascalientes y Colima no se ha encontrado ninguna cita en la literatura. Leavenworth (1946) realizó un estudio bastante detallado de un transecto entre el Cerro Tancítaro y el río Tepalcatepec, en Michoacán, área situada en los límites o más bien ligeramente fuera de la zona que se considera en este trabajo. Guzmán y Vela Gálvez (1960) publicaron más recientemente un artículo de tipo general sobre la parte suroeste de Zacatecas. Turner (1960) estudió en forma breve algunas comunidades vegetales de la zona próxima a Coahuayana, en Michoacán. Finalmente, Duellman (1965) incluyó un capítulo importante relativo a la vegetación de todo el Estado de Michoacán, en su trabajo biogeográfico sobre la herpetofauna de esa entidad.

En las contribuciones de Leopold (1950) y de Miranda y Hernández X. (1963), que se refieren a toda la República Mexicana, se describen someramente diversos tipos de vegetación presentes en Nueva Galicia y el primero de ellos incluye un mapa de distribución a escala pequeña.

En artículos de índole diversa se encuentran datos dispersos y observaciones aisladas sobre la vegetación de Jalisco y zonas vecinas. Entre tales publicaciones pueden mencionarse las de Kerber (1882a, 1882b), Gadow (1908), Gómez (1931), Pringle (Davis, 1936: 280 - 292), McVaugh (1952a, 1952b), Brand (1957 - 1958, 1960).

DELIMITACION Y DESCRIPCION FISIOGRAFICA DEL AREA

McVaugh (1961: 145 - 146; fig. 1) presenta las razones y los detalles de la delimitación del área estudiada. Esta a grandes rasgos corresponde al territorio del antiguo Virreinato de la Nueva Galicia, e incluye los estados de

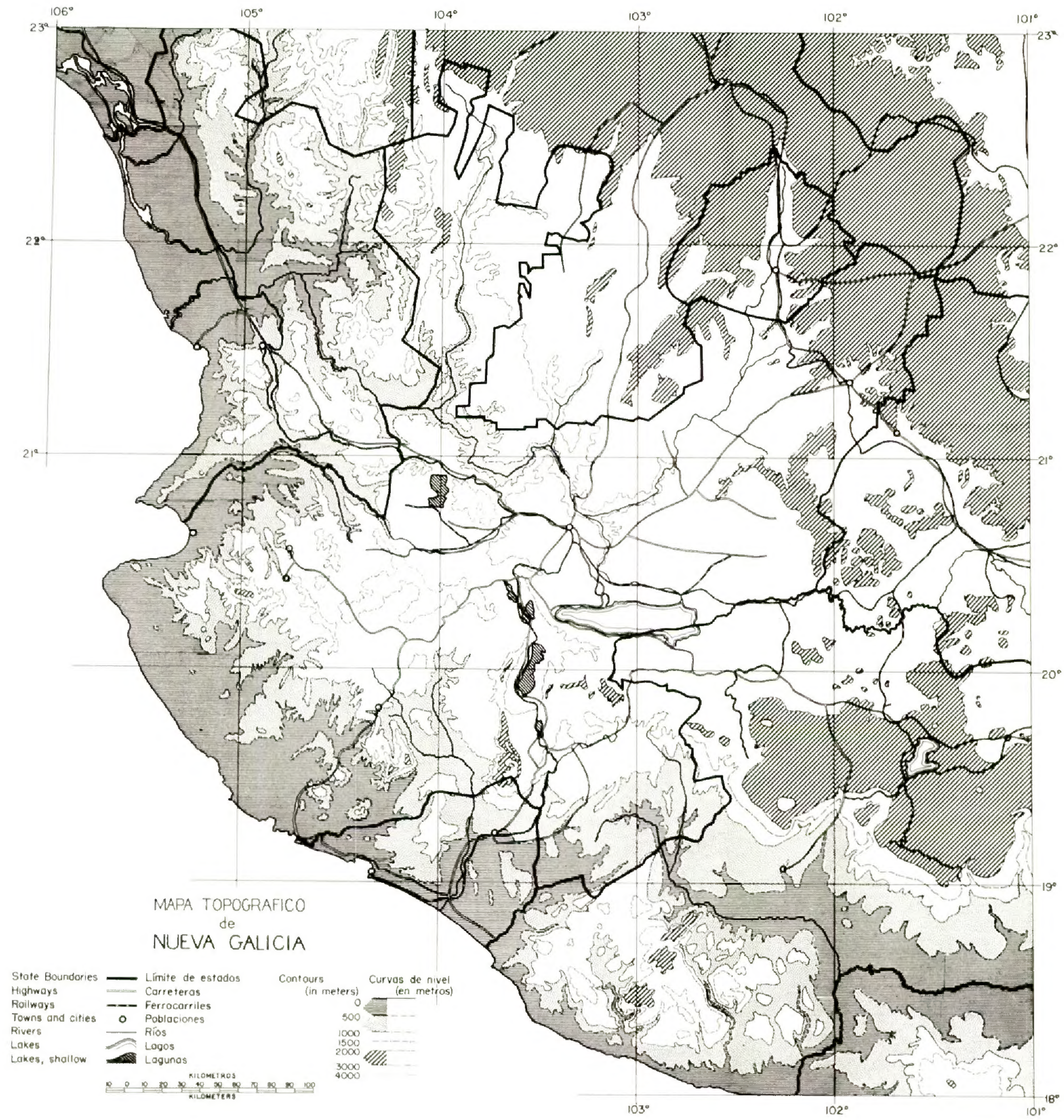

Fig. 1. El mapa topográfico da idea de la confluencia de diferentes regiones fisiográficas de México en el territorio de Nueva Galicia. La parte central y del NE, relativamente poco accidentada y más alta, corresponde a la Altiplanicie Mexicana. El sector noroccidental representa el extremo S de la Sierra Madre Occidental. En la mitad meridional se observa una parte de la Depresión del Balsas, delimitada hacia el norte por el Eje Volcánico Transversal y hacia el sur por la Sierra Madre del Sur.

Jalisco, Colima y Aguascalientes, además de porciones de los de Nayarit, Durango, Zacatecas, Guanajuato y Michoacán. En tal forma definida el área abarca aproximadamente 125,000 km^2, con un litoral de unos 500 km de largo (véase también el mapa de la fig. 1).

En este territorio confluyen diversas unidades fisiográficas de la República Mexicana, como por ejemplo: Sierra Madre Occidental, Eje Volcánico Transversal, Sierra Madre del Sur, Altiplanicie Mexicana, Depresión del Balsas, etc. De cada una de ellas Nueva Galicia participa solamente en una pequeña parte marginal, y los límites precisos entre algunas son bastante difíciles de definir. Para fines prácticos y siguiendo en parte la nomenclatura regional conviene más emplear la clasificación propuesta por Gutiérrez Vázquez (1959: 11-32, fig. 4), quien distingue 4 provincias fisiográficas para el estado de Jalisco y zonas adyacentes, a mencionar: 1ª región de los Cañones; 2ª región de los Altos; 3ª región de las Cuencas Centrales, y 4ª región montañosa y declives del Pacífico (véase el mapa de la fig. 2).

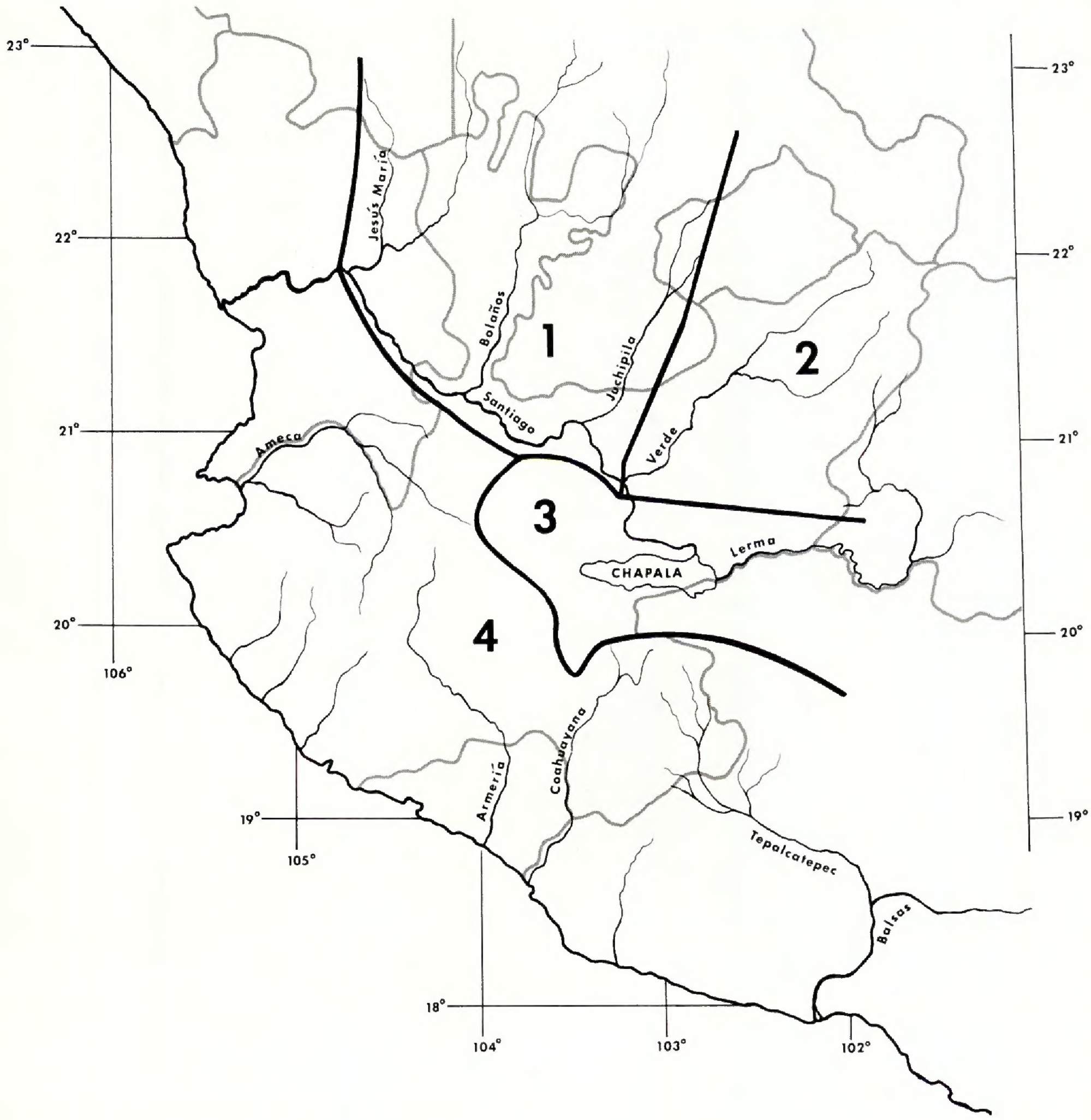

Fig. 2. Regiones fisiográficas y principales ríos de Nueva Galicia. 1. Región de los Cañones. 2. Región de los Altos. 3. Región de las Cuencas Centrales. 4. Región montañosa y declives del Pacífico.

La región de los Cañones, de relieve escarpado, corresponde a un área intensamente disecada por el río Santiago y los afluentes de su margen derecha. Los profundos cañones de estos últimos corren en forma más o menos paralela de norte a sur, estando separados por serranías alineadas en el mismo sentido. Las laderas occidentales generalmente son más pendientes que las orientales (Gutiérrez Vázquez, op. cit.: 12) y el desnivel entre el fondo de la barranca y las montañas circundantes normalmente pasa de 700 m y a veces de 1500 m. La altitud varía entre 200 m en las partes inferiores del río Santiago y cerca de 2800 m en la cumbre más alta, pero en general se mantiene entre 500 y 2400 m.

La región de los Altos es la de topografía más uniforme y participa de la Altiplanicie Mexicana. Tiene el aspecto de una plataforma algo inclinada en el sentido NE-SW, desde las llanuras de Ojuelos, situadas a 2200 m de altitud hasta las de Tepatitlán, que se encuentran a unos 1600 m. Macizos montañosos aislados llegan a medir hasta 2700 m sobre el nivel del mar.

La región de las Cuencas Centrales se define claramente por una serie de depósitos lacustres antiguos o actuales, situados entre Guadalajara, Ameca, Ciudad Guzmán y Jiquilpan, que se hallan separadas entre sí por sierras y sierritas de magnitud diversa. Los vasos de Chapala, de Sayula y de Zacoalco son los más notables entre los actuales. La altitud de los fondos lacustres varía entre 1250 y 1600 m, la de las montañas intercaladas llega hasta cerca de 3000 m.

La región montañosa y declives del Pacífico es la más heterogénea de todas, pues además de representar el área de confluencia de la Sierra Madre Occidental, del Eje Volcánico Transversal y de la Sierra Madre del Sur, incluye una porción de la Depresión del Balsas y una serie de pequeñas planicies costeras en el litoral Pacífico. Como el nombre lo indica, la región es predominantemente montañosa en su relieve y los valles son en general de poca extensión y significación. Las sierras frecuentemente se inician desde el punto de contacto con el Océano mismo; las próximas a la costa, sin embargo, rara vez llegan a medir 1200 m de altitud. Más tierra adentro los cerros alcanzan con frecuencia la cota de 1500 m, y las elevaciones más prominentes se encuentran en el área del Nevado de Colima (4330 m) y del Cerro Tancítaro (3960 m). Tres llanuras costeras merecen mencionarse por su extensión: la del Valle de Banderas, que corresponde a la desembocadura del río Ameca; la de Tomatlán; y la de Tecomán, que fue formada por los sedimentos aportados por los ríos Armería y Coahuayana.

Las rocas volcánicas, principalmente del Cenozoico Medio y Superior (riolitas, andesitas y basaltos), predominan en Nueva Galicia, alternando frecuentemente con aluviones recientes. Solamente la franja costera, de unos 150 km de ancho, ofrece una mayor diversidad de substrato geológico. Ahí afloran rocas intrusivas (granitos y rocas afines) del Mesozoico y del Cenozoico, rocas metamórficas paleozoicas (gneiss, esquistos y otras) y calizas del Cretácico Inferior, estas últimas sobre todo en el sur de Jalisco, en Colima y en zonas adyacentes de Michoacán. Un pequeño afloramiento de calizas de edad similar se localiza también al este de Rincón de Romos en Aguascalientes.

Hidrologicamente más de la mitad del territorio estudiado pertenece a la cuenca de Lerma - Santiago; a través de este sistema se drena toda la región de los Cañones, casi toda la de los Altos y la mayor parte de la de las Cuencas Centrales. Una pequeña zona perteneciente a la región montañosa y declives del Pacífico forma parte de la cuenca del río Balsas, a través del río Tepalcatepec; es el extremo SE de Nueva Galicia. El resto de esta última región desagua a través de ríos de menor significación directamente al Océano Pacífico, los más importantes de los cuales son los Ameca y Armería. Los

lagos de Sayula, de Zacoalco y algunos más forman pequeñas áreas de drenaje endorreico en la región de las Cuencas Centrales. Igualmente sin desagüe hacia el mar quedan algunas zonas del estado de Aguascalientes y la región de Ojuelos, en el extremo noreste de Jalisco.

CLIMA

La variada topografía de Nueva Galicia tiene su reflejo en una notable diversidad de climas. El ecuador térmico toca el extremo sur del área, y por otra parte en las cumbres del Tancítaro y del Nevado de Colima se alcanza el límite de la vegetación arbórea. Faltan los climas francamente húmedo y francamente árido, pero existe toda la amplitud de situaciones intermedias. Como caracteres climáticos notables de toda la zona deben resaltarse la ausencia de estaciones térmicas marcadas y la presencia de dos estaciones hídricas muy bien definidas.

La temperatura parece alcanzar valores más altos en el Valle del río Tepalcatepec, que participa de la depresión del Balsas, y donde en promedio anual se registran temperaturas hasta de 29° C. En la faja costera el calor es un poco menos intenso y las temperaturas medias anuales se mantienen entre 25 y 27°C; a altitudes cercanas a 1600 m sus valores son alrededor de 20°C. De acuerdo con Gutiérrez Vázquez (1959: 57) el gradiente térmico promedio por debajo de 1200 m de altitud es de 0.0031, y por encima de esta cota aumenta a 0.0045.

La zona libre de heladas se encuentra por lo general por debajo de 1200 m de altitud, pero en algunas localidades asciende hasta llegar a cerca de 1600 m sobre el nivel del mar.

El mes más caliente es comunmente mayo o junio, y enero el más frío; las diferencias entre sus temperaturas medias varían entre 2.5 y 10°C, aumentando por regla general de la costa hacia el interior. Las temperaturas máximas extremas alcanzan valores cercanos a 50° C en las zonas más cálidas.

En la fig. 3 se representa la distribución de isoyetas medias anuales, obtenidas a base de datos de 187 estaciones meteorológicas. En ciertas áreas, particularmente en la región de los Canoñes, el número de estaciones fue insuficiente y las líneas se trazaron tomando en cuenta la topografía y sobre todo la vegetación.

De este mapa se desprende que la zona más pobre en precipitación se localiza hacia el extremo nor-oriental, donde llueve menos de 500 mm en promedio anual (385 mm es la media más baja registrada). Las fajas más húmedas están situadas en algunas sierras cercanas a la costa de Jalisco y Nayarit, con precipitación superior a 1500 mm (de haber áreas en que llueve más de 2000 mm, éstas deben ser muy limitadas). En general valores mayores de 1000 mm se limitan a las regiones montañosas, en cambio las zonas donde llueve entre 750 y 1000 mm son las que mayor superficie ocupan en Nueva Galicia. Las partes bajas de la depresión correspondiente a la cuenca del Balsas y a las pequeñas planicies costeras de Tomatlán y de Tecomán, con precipitaciones inferiores a 750 mm, son también marcadamente secas, dadas las temperaturas elevadas que prevalecen ahí.

En cuanto al régimen se refiere, por lo general más del 90% de la lluvia cae, en promedio, en los meses de mayo a octubre, con lo cual el año se divide en un período húmedo y otro seco; la duración del último varía de 5 a 8 meses. Las precipitaciones suelen ser de tipo torrencial y de duración corta; se producen generalmente por las tardes.

Son escasos los datos referentes a la humedad atmosférica relativa. A base de 9 estaciones que registran este parámetro, se puede deducir que valores superiores a 75% en promedio anual se alcanzan en la franja costera y particularmente en las montañas cercanas a la misma. Hacia el extremo noreste, en la zona de Aguascalientes y Lagos de Moreno, la media anual es solamente de unos 50%. En el resto del territorio de Nueva Galicia los valores de humedad relativa son intermedios entre las dos cifras mencionadas.

Gutiérrez Vázquez (1959) presenta un mapa de climas del estado de Jalisco, elaborado de acuerdo con el criterio de Koeppen. Según la mencionada autora, dominan en el área los climas de tipo Cwag y Awg. Además se localizan los siguientes: Awgi, Cwa (?), BShwg, BSkwg, Cwbg, BSh'wg, Aw, Cwcg y ET, en orden de importancia decreciente.

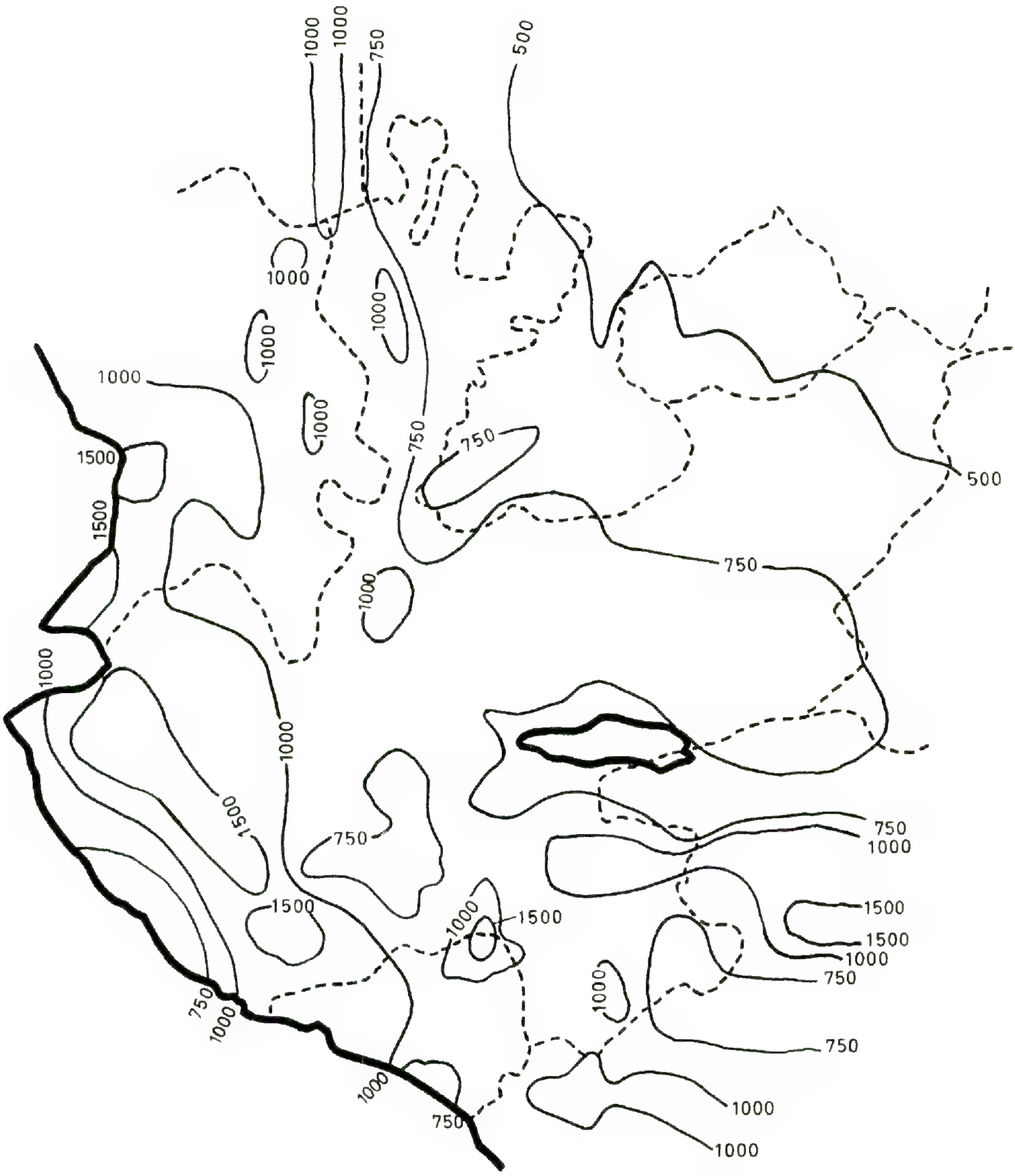

Fig. 3. Nueva Galicia. Esquema de isoyetas medias anuales en mm.

INFLUENCIA HUMANA

Este factor es muy de tomarse en cuenta, aunque la intensidad de las modificaciones de la vegetación, debidas directa o indirectamente a las actividades del hombre, varía de un sitio a otro.

La influencia humana sobre la vegetación natural es particularmente acentuada en la región fisiográfica de las Cuencas Centrales (alrededores de Guadalajara y del Lago de Chapala), zona que parece haber sido densamente habitada desde tiempos prehispánicos. El impacto del hombre es ligeramente menos acentuado hacia el noreste, noroeste y sur, y alcanza su mínima importancia relativa en la faja costera de Jalisco, donde la densidad de población aún es baja.

Las principales causas de disturbio que sufre la vegetación natural en el área estudiada son agricultura seminómada, ganadería y corte de árboles para leña y carbon. Las primeras dos implican comunmente el uso periódico del fuego, siendo tan extendida la práctica de incendiar la vegetación, que la composición de la misma se modifica con el tiempo, adaptándose a este factor ecológico. De manera semejante influye el intenso pastoreo, que hace disminuir o desaparecer las especies palatables en favor de otras que no toca el ganado.

En resumen, puede afirmarse que, con excepción de algunas regiones próximas al litoral del Pacífico, son escasas las áreas en que la vegetación se vea libre de los efectos de disturbio humano.

FLORA

El área que denominamos Nueva Galicia queda incluida dentro de una región florística más bien natural que se extiende aproximadamente desde el centro de Sinaloa hacia el sur, a través de Nayarit, Jalisco y Colima y luego a lo largo del litoral del Pacífico hasta Guerrero y Oaxaca (McVaugh y Rzedowski, 1965: 318-319). La flora de Nueva Galicia resulta por consiguiente estrechamente relacionada con la de la Sierra Madre del Sur; contiene algunos elementos propios de los zacatales y matorrales xerófilos de la Altiplanicie, pero posee pocas especies en común con la flora del Desierto Sonorense y con la de las Montañas Rocallosas, aunque no son raras las áreas de distribución que se extienden a lo largo de la Sierra Madre Occidental hasta Chihuahua. Muchos géneros y especies propias del Eje Volcánico Transversal existen en Nueva Galicia, al mismo tiempo que en las partes altas de Michoacán, Puebla y Veracruz, pero puede observarse una zona de discontinuidad en el centro de Michoacán, a resultas de la cual numerosas especies bien conocidas de los alrededores de la ciudad de México faltan al oeste de Morelia.

Llevando este somero análisis a relaciones con áreas florísticas de mayor jerarquía, el rasgo más notable de la flora de Nueva Galicia es su fuerte carácter mexicano o mexicano-centroamericano. A nivel de género resulta clara la afinidad de las zonas calientes con el reino neotropical y de las zonas de clima más fresco con el dominio holárctico y en parte con el andino. Las especies, sin embargo, son casi todas de distribución restringida a Mesoamérica y con más frecuencia a solo una pequeña fracción de su territorio. La importancia de los elementos autóctonos, expresada tanto en términos de su participación cuantitativa como en términos de su nivel taxonómico aumenta en general al disminuir la humedad disponible para las plantas (comp. en Rzedowski, 1962: 54-55).

En las descripciones que siguen enumeramos unas 1400 especies y variedades de plantas vasculares, entre las dominantes y las más características de los diferentes tipos de vegetación.

La inclusión de las Pteridofitas obedece sobre todo a la circunstancia de que estas plantas constituyen un elemento importante de la flora y de la vegetación de muchas partes de Nueva Galicia. Se les puede encontrar en casi todos los habitats, excepto quizás el zacatal homogéneo de las llanuras. Muchas especies de los géneros *Bommeria*, *Cheilanthes*, *Notholaena*, *Pellaea*, *Polypodium* y *Selaginella* son rupícolas, especialmente en condiciones de clima más seco, y con frecuencia se pueden localizar sobre laderas o peñascos rocosos que constituyen "islotes" más áridos en medio del zacatal, del bosque de pino y encino o del bosque tropical deciduo. Estas mismas especies pueden ser componentes normales del matorral crasicaule o del matorral subtropical. En el bosque tropical subdeciduo, en el bosque mesófilo de montaña y en el bosque de oyamel las Pteridofitas forman parte importante del estrato inferior de la comunidad o bien viven como epifitas, como por ejemplo los representantes de los géneros *Adiantum*, *Asplenium*, *Dryopteris*, *Polypodium*.

Hemos obtenido de fuentes diversas los nombres de los taxa tratados en esta obra. La mayor parte de tales nombres se han definido por medio de la identificación de nuestros propios ejemplares y en menor extensión de los de otros colectores. A medida de avanzar los estudios taxonómicos resulta cada vez más evidente que la flora incluye un considerable número de especies endémicas, aunque por otra parte muchos de los supuestos endemismos demuestran no ser sino poblaciones locales de especies de distribución más amplia. En todos los grupos hasta ahora revisados para la Flora Novo-Galiciana se encontró un número significativo de elementos nuevos para la ciencia. Se está llevando a cabo el estudio taxonómico crítico de la flora vascular entera, pero diversos problemas en grupos difíciles aún están sin resolverse y muchas de nuestras identificaciones deben interpretarse a la luz de esta circunstancia.

Nuestros ejemplares se distribuyeron a los siguientes herbarios: Herbario Nacional del Instituto de Biología, México, D.F. (MEXU); Herbario de la Escuela Nacional de Ciencias Biológicas, México, D.F. (ENCB); y Herbario de la Universidad de Michigan, Ann Arbor, Michigan, E.U.A. (MICH). Se han enviado, o se enviarán, duplicados a otras instituciones.

TIPOS DE VEGETACION

Basándose fundamentalmente en datos de orden fisonómico, pero tomando también en cuenta otros aspectos, se han distinguido 13 tipos de vegetación (o formaciones) como características en el área de estudio. Todos ellos se describen a continuación, incluyendo breves discusiones relativas a su distribución geográfica, a las exigencias ecológicas de cada uno, y otras observaciones que se consideraron de interés.

En cuanto a la cartografía de la vegetación (véase mapa al final del texto), la intensidad de la exploración realizada no fue suficiente ni suficientemente uniforme para pretender elaborar un mapa definitivo. Vastas áreas, especialmente en la región de los Cañones y en la costa no fueron visitadas, sino muy fragmentariamente. Por fortuna, se dispuso de la información contenida en fotografías aéreas para la mayor parte de la zona estudiada, pues se consultaron las correspondientes a toda la cuenca Lerma - Santiago y a una franja de aproximadamente 100 km de amplitud que corre paralela al litoral del Pacífico, desde Manzanillo hasta Puerto Vallarta. La región montañosa de la Sierra Madre de Durango y de Nayarit, así como un cinturón de unos 50 km de ancho entre Compostela y Tomatlán, son quizás las dos áreas más débiles en lo tocante a la cartografía de su vegetación y probablemente habrá necesidad de rectificar límites ahí.

Debido a la complicada topografía de muchas áreas, que tiene su fiel reflejo en la distribución de la vegetación, ha habido necesidad de recurrir con frecuencia a generalizaciones, en perjuicio de la precisión del mapa. En virtud de ello el lector debe quedar advertido que el haber cartografiado un determinado tipo de vegetación sobre una superficie definida no significa necesariamente que éste se extienda ininterrumpidamente en toda el área marcada, sino más bien que es el que con mayor frecuencia puede encontrarse ahí.

Debido a las mismas causas no se han incluido en el mapa varios de los tipos de vegetación, cuyas áreas se han estimado demasiado pequeñas o fragmentarias para lograr una representación adecuada a la escala empleada.

Es pertinente recordar también que en Jalisco se localiza una de las zonas agrícolas más importantes de la República y que se cultiva en casi todas las superficies susceptibles. Al cartografiar estas áreas se ha intentado interpretar la vegetación potencial correspondiente.

En las páginas 10-11 se incluye un resumen tabular de los 13 tipos de vegetación, en el cual se concentran algunos de sus rasgos ecológicos, sus componentes florísticos más notables, así como una estimación de su extensión superficial relativa.

SUMARIO TABULAR DE LOS TIPOS DE VEGETACION

Tipo de Vegetación	Extensión aproximada en Nueva Galicia %	Límites altitudinales m	Temperatura media anual °C	Temperatura mínima extrema °C	Precipitación media anual mm
Palmar	<1	0 - 50	25 - 27	>0	?600 - ?1000
Bosque tropical subdeciduo	±10	0 - 1200	22 - 27	>0	750 - ?1600
Bosque tropical deciduo	15 - 20	0 - 1600	20 - 28	±0	600 - 1000
Bosque espinoso	2 - 3	0 - 2000	17 - 29	<0	500 - 750
Matorral subtropical	15 - 20	1500 - 2000	17 - 21	<0	500 - 900
Vegetación sabanoide	±1	50 - 800	23 - 27 ?	>0	?700 - ?1200
Zacatal	15 - 20	1700 - 4300	3 - 18	<0	350 - ?800
Matorral crasicaule	±1	1800 - 2200	16 - 18	<0	350 - 550
Bosque de pino y encino	25 - 30	300 - 4000	5 - 25	<0	400 - ?1500
Bosque mesófilo de montaña	<1	800 - 2400	15 - 23 ?	<0	?1000 - ?2000
Bosque de oyamel	<1	1500 - 3500	7 - 21 ?	<0	?1000 - ?1500
Vegetación acuática	±1	0 - 4000	5 - 29	<0	350 - ?2000
Manglar	<1	0 - 5	25 - 27	>0	?600 - ?1000

SUMARIO TABULAR DE LOS TIPOS DE VEGETACION (continuación)

Preferencia de suelo	Plantas características
Arenas cercanas a las playas	Orbignya cohune, Ficus spp.
–	Brosimum alicastrum, Bumelia cartilaginea, Bursera arborea, Celtis monoica, Enterolobium cyclocarpum, Ficus spp., Hura polyandra
Somero de ladera	Amphipterygium spp., Bursera spp., Ceiba aesculifolia, Loncho-carpus spp., Lysiloma divaricata
Profundo	Acacia spp., Caesalpinia spp., Cercidium praecox, Haematoxylon brasiletto, Pithecellobium dulce, Prosopis laevigata, Ziziphus spp.
Somero de ladera	Acacia pennatula, Eysenhardtia polystachya, Forestiera spp., Ipomoea spp., Opuntia fuliginosa
–	Byrsonima crassifolia, Crescentia alata, Curatella americana
–	Andropogon spp., Aristida spp., Bouteloua spp., Hilaria cench-roides, Muhlenbergia spp., Acacia tortuosa
–	Opuntia guilanchi, Opuntia streptacantha, Mimosa biuncifera, Mimosa monancistra
–	Pinus spp., Quercus spp., Arbutus spp.
Somero de ladera	Carpinus caroliniana, Clethra spp., Prunus spp., Quercus acutifolia, Styrax spp., Symplocos prionophylla
Somero de ladera	Abies spp., Alnus firmifolia, Meliosma dentata, Quercus laurina
–	
Salino de orillas de esteros	Rhizophora mangle, Avicennia nitida

Fig. 4. Palmar de *Orbignya cohune*, cerca de Las Varas, Nay. (Fot. Tad Nichols, reproducida gracias a la amabilidad del fotógrafo y la del Sr. Dale Stuart King, editor del libro *Meet Flora Mexicana* de M. Walter Pesman).

PALMAR

Se describirá bajo este nombre la comunidad dominada por *Orbignya cohune*, propia de algunas localidades cercanas a la costa de Nueva Galicia.

Otra especie de la misma familia, *Sabal rosei*, puede ser frecuente en los declives de la sierra al norte de Tepic, pero se trata evidentemente de una invasión secundaria y la palma no llega a ser dominante en ningún lugar visitado.

En la cuenca del Balsas se conocen áreas cubiertas por palmares de *Brahea dulcis* y otros de *Sabal pumos*, en general intercalados entre los bosques de pino y encino por un lado, y los bosques tropicales por el otro. No es imposible que alguno de estos enclaves pueda localizarse en el área bajo estudio, aunque los autores no lo han observado.

El bosque de *Orbignya* se presenta sobre arenas profundas y bien drenadas de los lugares próximos al litoral y en los cuales aparentemente el agua freática está al alcance de las raices de las palmeras. Su distribución geográfica es discontinua, pues se le localiza casi siempre a lo largo de las bahías y ensenadas, en forma de manchones que pueden ser de 10 km o un poco más de largo, pero rara vez pasan de 5 km de ancho. Las zonas de mayor concentración se localizan en las costas del sur de Nayarit y a lo largo del litoral de Colima.

La especie dominante, *Orbigyna cohune*, es un árbol de interés económico, pues sus frutos se colectan en grandes cantidades y las semillas, además de comestibles, se aprovechan como materia prima en la industria de las grasas. Su rendimiento, sin embargo, es inferior al de la palma cocotera (*Cocos nucifera*) y puesto que los requerimientos ecológicos de ambas especies son más o menos similares, los bosques de *Orbignya* están siendo substituidos por las plantaciones de coco. De hecho, en la costa de Colima ya no quedan muchas extensiones de palmar primitivo; en Jalisco y Nayarit se conservan un poco mejor, pero al terminarse de construir la carretera costera es probable que desaparecerán con gran rapidez.

Por su fisonomía el palmar de *Orbignya* es indudablemente el tipo de vegetación más majestuoso de Nueva Galicia. El bosque tiene 15 a 30 m de alto y es tan denso como para crear condiciones de penumbra al nivel del suelo (Figs. 4, 5). La dominancia de *Orbignya* es absoluta y sólo puede haber árboles esporádicos de otras especies en el estrato alto, como por ejemplo *Ficus padifolia*, *F. glabrata*, *F. glaucescens*, *F. lentiginosa*, *Brosimum alicastrum*, *Dendropanax arboreus*, *Enterolobium cyclocarpum*, *Bursera* aff. *simaruba*.

Un estrato de árboles más bajos a menudo incluye:

Acacia sp.
Annona sp.
Ardisia revoluta
Bravaisia integerrima
Coccoloba barbadensis
Coccoloba floribunda
Colubrina triflora
Cordia alliodora
Cupania aff. *glabra*
Godmania aesculifolia
Guarea excelsa
Nectandra perdubia
Swartzia ochnacea
Thevetia plumeriifolia
Thouinidium decandrum
Trichilia hirta

Se desconoce cual ha sido la composición de los estratos arbustivo y herbáceo, pues éstos se hallan intensamente perturbados en todos los sitios que se han visto. Entre los arbustos encontrados pueden mencionarse:

Acacia farnesiana
Acanthocereus occidentalis
Bromelia karatas
Cassia oxyphylla
Celtis iguanea
Cnidoscolus tubulosus
Eugenia acapulcensis
Eupatorium quadrangulare
Forchhammeria sessilifolia
Garcia nutans
Helicteres guazumifolia
Hybanthus aff. *mexicanus*
Hybanthus yucatanensis
Hyperbaena ilicifolia
Morisonia americana
Ouratea mexicana
Picramnia antidesma
Piper spp.
Pisonia aculeata
Pithecellobium lanceolatum
Quassia amara
Randia armata
Rauwolfia hirsuta
Solanum bicolor
Thevetia peruviana
Trichilia havanensis
Xylosma flexuosum

Como se indica en la descripción del bosque tropical subdeciduo, *Orbignya* puede formar parte de él, a menudo siendo codominante en sitios poco alejados de la costa. Se desconoce la razón por la cual esta palma está ausente en condiciones aparentemente análogas, pero a mayor distancia del litoral.

Fig. 5. Palmar de *Orbignya cohune*, cerca de Las Varas, Nay. Nótense los individuos de *Ficus* spp. que inician su vida como epifitos sobre las palmeras. (Fot. Rzedowski).

BOSQUE TROPICAL SUBDECIDUO

De entre los tipos de vegetación que se describen en la presente contribución éste es indudablemente el más exuberante, el más complejo por su estructura así como por su composición florística. Su fisonomía y su fenología colocan a esta formación en una situación intermedia entre el bosque tropical perennifolio y el bosque tropical deciduo, pues si bien la gran mayoría de las especies pierde sus hojas durante el período seco, hay muchos árboles que no se defolian totalmente y otros lo realizan por un período corto, a veces sólo de unas semanas. La altura del estrato dominante es invariablemente mayor que en el caso del bosque tropical deciduo, al igual que la abundancia de lianas, epifitas y plantas esciófilas.

El verdadero bosque tropical perennifolio aparentemente no existe en la vertiente pacífica de México más al norte del Istmo de Tehuantepec, y lo único que pudiera asemejársele se encuentra en algunos sitios protegidos dentro del área general del bosque tropical subdeciduo. Estos manchones se localizan con cierta frecuencia en Nayarit, entre Tepic y el litoral del Pacífico. Por su fenología y estructura quizás ameriten clasificarse como bosque tropical subperennifolio, pero su extensión es tan reducida y su composición florística tan poco diferente del bosque tropical subdeciduo, que se ha optado por mencionar sólo su existencia en este sitio.

Miranda (1958: 232-236) describe en la Península de Yucatán lo que denomina "selva alta o mediana subdecidua," que parece ser equivalente al bosque tropical subdeciduo de Nueva Galicia. Este tipo de vegetación tiene una distribución algo irregular en el país y no ocupa grandes extensiones en la vertiente del Golfo de México. En cambio, en los declives pacíficos parece extenderse en forma de una franja estrecha y más o menos continua desde Chiapas hasta Nayarit y posiblemente hasta Sinaloa. De la parte central de este último estado Gentry (1946b: 359) refiere bajo el nombre de "apomal" una comunidad que, de corresponder al bosque tropical subdeciduo, representaría quizás su extremo nor-occidental. Posiblemente se trate de un manchón aislado.

El bosque tropical subdeciduo es de importancia económica por incluir varias especies arbóreas de maderas preciosas, y sobre todo porque el microclima al abrigo de los árboles es con frecuencia favorable para el cultivo del café, que está particularmente extendido en las zonas costeras de Guerrero y Oaxaca.

En Nueva Galicia el bosque tropical subdeciduo parece estar confinado a las áreas poco elevadas y no demasiado alejadas del mar. Una franja probablemente continua se extiende a lo largo de la costa desde el sur de Nayarit hasta cerca de Manzanillo, desde donde su zona de distribución se interna para ocupar los declives inferiores occidentales, meridionales y orientales del macizo del Nevado de Colima. Las áreas inmediatas a la costa desde los alrededores de Manzanillo hacia el sureste se caracterizan por una vegetación más xerófila, pero ya dentro del territorio del estado de Michoacán una área continua del bosque tropical subdeciduo aparentemente vuelve a alcanzar el litoral más o menos a la altura de la Bahía de Tizupan, como puede deducirse indirectamente de las fotografías de Brand (1957-1958).

El tipo de vegetación que se describe es evidentemente muy termófilo en sus exigencias ecológicas y existe sólo en áreas en que las heladas no se presentan nunca. No se le ha observado a altitudes superiores de 1200 m, por

lo cual las temperaturas medias anuales dentro de su área de distribución son superiores a 21°C. La precipitación en casi todo el territorio ocupado por el bosque tropical subdeciduo de Nueva Galicia es en promedio anual superior a 900 mm. En ciertas áreas de Nayarit y Jalisco excede de 1500 mm, pero en los alrededores de Colima es sólo del orden de 850 mm y en Cabo Corrientes de 750 mm. Es probable que en estas dos regiones se compense la falta de lluvia a través de alta humedad atmosférica o quizás algún otro factor ecológico.

Los suelos característicos del bosque tropical subdeciduo pueden ser someros o profundos y de textura muy variable, desde francamente arcillosos hasta arenas casi puras. El contenido de materia orgánica suele ser elevado, al menos en el horizonte en contacto directo con la hojarasca. La acidez medida en valores de pH se encontró entre límites de 4 a 6.5.

A pesar de que a priori podría pensarse en lo contrario, el bosque tropical subdeciduo en Nueva Galicia es uno de los tipos de vegetación relativamente mejor conservados, aún hoy en día. Tal circunstancia es cierta en particular para el estado de Jalisco y su explicación debe buscarse en la baja densidad de la población humana en toda la región costera de esta entidad federativa. La zona ha permanecido aislada de la civilización durante mucho tiempo y aún en el presente no parece constituir un gran atractivo para una colonización más intensa. Estas condiciones no se mantendrán probablemente por mucho más tiempo. Aunque sería difícil hacer un cálculo exacto, de acuerdo con las estimaciones de los autores, cerca de la mitad del área total señalada para esta formación en Nueva Galicia posiblemente está cubierta todavía por un tapiz vegetal no muy diferente del clímax. En muchas partes la agricultura se ha limitado a ocupar los suelos profundos de los valles y la ganadería no parece ser muy importante. Ciertos sectores han sido sometidos a la explotación forestal (principalmente de *Cedrela*, *Cybistax*, *Enterolobium*, *Tabebuia*, *Swietenia*, *Hura* y *Brosimum*), aunque esta última nunca fue muy severa. Los incendios no se propagan con tanta facilidad en este tipo de vegetación y la demanda de leña es relativamente escasa.

El bosque tropical subdeciduo suele presentarse bajo la forma de comunidad forestal densa, de manera que en la época lluviosa el suelo se encuentra en condiciones de penumbra, inclusive a las horas de mayor insolación. Su altura varía entre 15 y 35 m, más frecuentemente alrededor de los 25 m. Los árboles del estrato dominante se caracterizan por sus troncos más o menos derechos y desprovistos de ramas hasta lo alto de la bóveda, o ramificándose en la mitad superior (Figs. 6, 7). En condiciones naturales de crecimiento el diámetro de la copa suele ser mucho menor que la altura de la planta. Algunas especies pueden presentar raices tabulares más o menos desarrolladas; el grosor de los troncos rara vez llega a 1 m, por lo general oscila entre 30 y 60 cm. La corteza de muchas de las especies tiene un color blanquecino característico, que al parecer se debe a la presencia de un líquen crustáceo que la cubre casi por completo. Con frecuencia, asimismo, esta corteza está partida de tal manera que recuerda un poco las tejas de un techo. Las especies estranguladoras de *Ficus* llegan a ser frecuentes en algunas localidades.

El tamaño predominante de la hoja o foliolo es mediano (categoría de mesófilo de la clasificación de Raunkiaer), existiendo también especies de foliolo muy pequeño (*Lysiloma divaricata*, *Enterolobium cyclocarpum*). La gran mayoría de las plantas es de hoja decidua, pero en varias la pérdida del follaje en tiempo seco parece ser más o menos facultativa, de modo que en años muy secos la defoliación es usualmente más pronunciada y más prolongada que en los húmedos. El período de franca carencia de hojas dura de 1 a 4 meses. Algunas especies, como *Ficus* spp. y *Orbignya cohune* son perennifolios.

No quedan muchos restos de bosque tropical subdeciduo sobre suelos profundos, pero de los vestigios que en ocasiones pueden encontrarse es factible deducir que éste parece haber tenido una composición florística bastante uniforme y definida, con predominancia de varias especies de *Ficus* (*F. glabrata*, *F. padifolia*, *F. involuta)*, casi siempre con *Enterolobium cyclocarpum*. Otros árboles más o menos frecuentes en el estrato dominante de este tipo de bosque deben haber sido: *Ceiba pentandra*, *Hura polyandra*, *Salix chilensis*, *Bumelia cartilaginea*, *Pithecellobium lanceolatum*. En condiciones de deficiencia de drenaje los *Ficus* son practicamente dueños del terreno, pero en lugares de fácil desagüe *Enterolobium* siempre es muy frecuente.

Sobre suelos someros de las laderas de los cerros el bosque tropical subdeciduo se presenta bajo la forma de diversas asociaciones. *Brosimum alicastrum* es indudablemente la especie más característica, siendo casi siempre dominante o codominante sobre laderas calizas, pero de ninguna manera

Fig. 6. Bosque tropical subdeciduo, cerca de Barra de Navidad, Jal., con *Brosimum alicastrum*, *Astronium graveolens*, *Orbignya cohune*. (Fot. Rzedowski).

Fig. 7. Restos del bosque tropical subdeciduo, cerca de Las Varas, Nay. En primer plano *Brosimum alicastrum*, atrás *Orbignya cohune*. (Fot. McVaugh).

restringida a este substrato, como parece suceder en la vertiente atlántica de México. Con *Brosimum* suele estar asociada *Celtis monoica* y a menudo también algunos de los siguientes árboles altos:

Aralia sp.
Astronium graveolens
Bernoullia flammea
Bursera arborea
Calophyllum brasiliense var. *rekoi*
Cedrela sp.
Cnidoscolus sp.
Conzattia multiflora
Cordia alliodora
Cordia elaeagnoides
Couepia polyandra
Coussapoa aff. *purpusii*
Cybistax donnell-smithii
Dendropanax arboreus
Dipholis minutiflora
Drypetes lateriflora
Enterolobium cyclocarpum
Ficus cotinifolia
Ficus glabrata
Ficus glaucescens
Ficus involuta
Ficus lentiginosa
Ficus mexicana
Ficus padifolia
Guarea excelsa
Hura polyandra
Hymenaea courbaril
Licaria cervantesii
Luehea candida
Lysiloma divaricata
Mastichodendron angustifolium
Mastichodendron capiri
Orbignya cohune
Persea sp.
Phoebe arsenii
Posoqueria latifolia
Pouteria campechiana var. *palmeri*
Swietenia humilis
Tabebuia palmeri
Tabebuia pentaphylla
Trophis racemosa

Orbignya puede ser bastante abundante en lugares próximos al mar, pero va desapareciendo al internarse el bosque hacia las sierras.

En las áreas cercanas a la costa al WNW de Manzanillo la comunidad está dominada por *Celaenodendron mexicanum* y *Bursera arborea;* en cambio sobre suelos originados de roca basáltica en los alrededores de Colima *Bumelia cartilaginea* es la especie prevaleciente. En algunas barrancas *Hura polyandra* y *Cnidoscolus* sp. llegan a ser dominantes; se han observado también bosques de *Tabebuia* spp. y *Cordia* spp., pero es factible que se trate de estados sucesionales avanzados.

Un estrato arbóreo inferior de 5 a 15 m de alto comunmente existe en el bosque tropical subdeciduo, aunque su densidad es muy variable. Se han observado en él:

Acacia langlassei
Apoplanesia paniculata
Ardisia compressa
Ardisia revoluta
Bauhinia subrotundifolia
Belotia mexicana
Bombax ellipticum
Bursera excelsa vars.
Bursera grandifolia
Bursera aff. *simaruba*
Carica mexicana
Ceiba aesculifolia
Cnidoscolus tubulosus
Coccoloba barbadensis
Coccoloba floribunda
Comocladia sp.
Cordia seleriana
Croton draco
Cupania glabra
Esenbeckia berlandieri
Eugenia michoacanensis
Eugenia rekoi
Eugenia salamensis
Euphorbia fulva
Exothea copalillo
Forchhammeria pallida
Heliocarpus cf. *occidentalis*
Heliocarpus pallidus
Inga eriocarpa
Inga laurina
Inga oophylla
Jatropha peltata

Lemaireocereus sp.
Lonchocarpus constrictus
Oxandra lanceolata subsp. *macrocarpa*
Parathesis spp.
Picramnia antidesma
Piptadenia constricta
Platymiscium trifoliolatum
Plumeria rubra
Poeppigia procera
Psidium sartorianum
Quassia amara
Ruprechtia fusca
Sapium pedicellatum
Schaefferia aff. *frutescens*
Swartzia ochnacea
Thouinia acuminata
Trema micrantha
Trichilia colimana
Trichilia palmeri
Triumfetta paniculata
Vitex hemsleyi

Las plantas arbustivas no abundan cuando el bosque se encuentra bien conservado, pero su densidad y diversidad aumenta mucho en sitios en que hay mayor penetración de luz. Forman un estrato de 1 a 4 m de alto, que sólo se vuelve difícil de atravesar en condiciones de fuerte disturbio. Las especies más frecuentemente encontradas fueron:

Acalypha cincta
Acalypha schiedeana
Amyris sylvatica
Aphelandra sp.
Arthrostylidium sp.
Barleria micans
Bernardia gentryana
Bernardia mexicana
Bromelia karatas
Bunchosia palmeri
Cassia biflora
Chamaedorea pochutlensis
Colubrina triflora
Cracca aletes
Cryosophila nana
Cynometra oaxacana
Eupatorium quadrangulare
Eupatorium tepicanum
Euphorbia pulcherrima
Galipea sp.
Hamelia xorullensis
Heliconia sp.
Hibiscus bifurcatus
Hirtella racemosa
Hybanthus aff. *mexicanus*
Hybanthus serrulatus
Hybanthus yucatanensis
Hyperbaena ilicifolia
Jacobinia roseana
Lasiacis ruscifolia
Malvaviscus arboreus
Margaritaria nobilis
Olyra latifolia
Onoseris onoseroides
Pavonia palmeri
Pedilanthus calcaratus
Pedilanthus palmeri
Phyllanthus acuminatus
Piper brachypus
Piper jalapense
Piper jaliscanum
Piper tuberculatum
Piper uhdei
Piper umbellatum
Psychotria sp.
Robinsonella sp.
Ruellia jaliscana
Tabernaemontana amygdalifolia
Vernonia palmeri
Xylosma velutinum
Zamia sp.

Las plantas herbáceas esciófilas de los estratos inferiores del bosque tropical subdeciduo rara vez son frecuentes, y en muchos lugares el suelo está casi completamente desprovisto de cubierta herbácea. Pueden mencionarse representantes de los siguientes géneros:

Achimenes
Adiantum
Anthurium
Arisaema
Begonia
Calathea
Commelina
Costus
Desmodium
Dorstenia

Henrya
Hybanthus
Jacobinia
Maranta
Monnieria
Odontonema
Oplismenus
Peperomia
Phaeosphaerion
Ruellia
Salpianthus
Spigelia
Xanthosoma
Zeugites

Las lianas y las epifitas suelen ser frecuentes y numerosas, pero su abundancia varía notablemente de un lugar a otro. Laderas protegidas, pequeñas barrancas y orillas de arroyos constituyen a menudo los habitats más favorables para el desarrollo de estas formas biológicas.

Las trepadoras leñosas altas incluyen entre otras:

Byttneria catalpifolia
Canavalia acuminata
Clematis dioica
Combretum farinosum
Combretum laxum
Cydista aequinoctialis
Drymonia sp.
Entada polystachia
Heteropteris laurifolia
Heteropteris palmeri
Hippocratea volubilis
Mandevilla subsagittata
Monstera sp.
Paullinia fuscescens
Paullinia sessiliflora
Petastoma patelliferum
Philodendron polytomum
Philodendron radiatum
Rourea glabra
Saldanhaea seemanniana
Securidaca diversifolia
Smilax spinosa
Solandra nitida
Strychnos brachistantha
Strychnos panamensis
Syngonium aff. *podophyllum*
Tetracera volubilis
Vitis tiliifolia

Las epifitas fanerogámicas son en su gran mayoría Monocotiledóneas de las dos familias más características: orquidáceas y bromeliáceas, como por ejemplo:

Aechmea bracteata
Anthurium fortinense
Anthurium sp.
Epidendrum barkeriola
Epidendrum chinense
Erycina echinata
Laelia sawyeri
Oncidium liebmannii
Tillandsia caput-medusae
Tillandsia schiedeana
Tillandsia sp.

Las comunidades secundarias que se originan a raíz del desmonte del bosque tropical subdeciduo son en general de tipo arbustivo o arbóreo, y sólo artificialmente puede mantenerse una cubierta herbácea que a menudo resulta más conveniente para fines de pastoreo u otro uso. Los elementos más característicos de estos matorrales y bosques de crecimiento secundario son los siguientes:

Acacia hindsii
Acalypha cincta
Acrocomia mexicana
Agdestis clematidea
Antigonon leptopus
Ardisia revoluta
Baccharis trinervis
Bauhinia ungulata
Bauhinia sp.
Bixa orellana
Bunchosia palmeri
Caesalpinia platyloba
Casearia arguta
Casearia dolichophylla
Cassia atomaria
Cassia nicaraguensis
Castilla elastica
Cecropia obtusifolia

Cnidoscolus tepiquensis
Cnidoscolus tubulosus
Cochlospermum vitifolium
Conostegia xalapensis
Cordia alliodora
Croton reflexifolius
Cyrtocarpa procera
Forchhammeria pallida
Gliricidia sepium
Gouania polygama
Gouania stipularis
Guazuma ulmifolia
Gyrocarpus americanus
Hamelia versicolor
Helicteres guazumifolia
Heliocarpus aff. *occidentalis*
Heliocarpus pallidus
Jacquinia aurantiaca
Liabum caducifolium
Liabum glabrum var. *hypoleucum*
Lysiloma acapulcensis
Muntingia calabura
Myriocarpa longipes
Phyllanthus micrandrus
Piper tuberculatum
Piptadenia constricta
Psidium guajava
Quassia amara
Randia armata
Randia cinerea
Rauwolfia hirsuta
Rourea glabra
Ruprechtia fusca
Sabal rosei
Sapindus saponaria
Sapium pedicellatum
Spondias purpurea
Stemmadenia tomentosa var.*palmeri*
Tabernaemontana amygdalifolia
Thouinia acuminata
Trema micrantha
Trichilia havanensis
Triumfetta polyandra
Urera baccifera
Urera caracasana
Verbesina crocata
Xylosma flexuosum
Zanthoxylum fagara

El bosque tropical subdeciduo se comporta de maneras diversas en las regiones en que se pone en contacto con otros tipos de vegetación. Límites claros y netos pueden observarse en los casos en que el factor edáfico parece ser el determinante. El límite con el palmar de *Orbignya cohune* está generalmente bien definido en función del suelo, pero como ya se indicó más arriba, la palma con frecuencia forma parte también del primero, de manera que no es raro encontrar grandes extensiones cubiertas por una comunidad aparentemente mixta de *Brosimum* y *Orbignya*, a veces también con otros árboles codominantes.

Los límites con la vegetación de tipo sabanoide o de bosque espinoso suelen ser también bastante claros y fáciles de observar, pues las diferencias fisonómicas son muy notables y la zona de transición reducida.

La situación suele ser diferente en los sitios en que el bosque tropical subdeciduo limita con el bosque tropical deciduo. Lo común en estos casos es que exista un amplio cinturón de transición en el cual la cubierta vegetal se dispone en forma de mosaico, ocupando el primer tipo de vegetación las cañadas y lugares protegidos en general, y el segundo los filos de las laderas y la mayoría de los sitios expuestos. Este mosaico es particularmente fácil de observar en los primeros meses de la época seca (noviembre a marzo), cuando el bosque subdeciduo está verde aún, en cambio el deciduo ya está totalmente desprovisto de follaje.

En forma semejante se presenta la transición con los bosques de pino-encino, en este caso casi siempre encinares, que frecuentemente descienden a lo largo de los filos hasta altitudes de 400 m, mientras el bosque tropical subdeciduo puede alcanzar elevaciones de 1000 m sobre el nivel del mar en el fondo del arroyo contiguo.

Una transición muy gradual, muchas veces con substitución paulatina de unas especies por otras, se ha observado en los sitios en que se ponen en contacto el bosque tropical subdeciduo y el bosque mesófilo de montaña.

BOSQUE TROPICAL DECIDUO

En esta formación se incluyen las comunidades vegetales caracterizadas por la dominancia de especies arbóreas no espinosas, de talla más bien modesta, que pierden sus hojas por un período prolongado, coincidiendo con la época seca del año.

El bosque tropical deciduo cubre una gran parte de los declives inferiores y medios de la vertiente pacífica de México y tiene una amplia distribución en la mitad sur-occidental de Nueva Galicia, aunque quizás no tan grande como podría deducirse del mapa de Leopold (1950). Esta aparente discrepancia se debe al hecho de que la circunscripción aquí adoptada del tipo de vegetación mencionado es más estrecha, reconociéndose como unidades independientes el bosque tropical subdeciduo y el matorral subtropical, tipos de vegetación fisonómica y floristicamente afines al bosque tropical deciduo y evidentemente incluidos en el último por Leopold.

Se le encuentra por lo común a altitudes entre 0 y 1600 m, más frecuentemente debajo de la cota de 1400 m, y las áreas en que está mejor representado se localizan en la mitad meridional de Colima, en la parte de Jalisco correspondiente a la cuenca del Balsas, en el valle superior del río Naranjo (que incluye la zona de Ciudad Guzmán y Tecalitlán), en la gran depresión del valle superior del río Armería y de sus afluentes (región de Autlán y Villa Carranza), en los valles de los afluentes superiores del río Ameca, en los declives de la sierra al oeste de Compostela y al norte de Tepic, en las laderas inferiores a lo largo de las barrancas del río Santiago y sus afluentes, donde en las localidades protegidas de exposición sur alcanza sus mayores altitudes.

El bosque tropical deciduo parece estar ecologicamente restringido a los suelos someros y de drenaje rápido de las laderas de los cerros, pues no se le encuentra sobre terrenos aluviales profundos. Estos últimos en la gran mayoría de los casos se emplean para la agricultura, pero hay bastantes indicios para suponer que antes de ser desmontados, sostenían una vegetación que aquí se clasifica como bosque espinoso (véase el inciso correspondiente). En consecuencia, dentro del área general señalada en el mapa adjunto como bosque tropical deciduo de hecho existen muy numerosos enclaves (potencialmente) ocupados por el bosque espinoso. En forma similar, en el interior de la zona marcada como bosque tropical subdeciduo existen frecuentes manchones de bosque deciduo, y viceversa, que no se señalan en el mapa por ser relativamente pequeños y por desconocerse su extensión y límites exactos.

Todo lo anteriormente expuesto puede dar idea de lo complejo de la distribución geográfica del bosque tropical deciduo en el área estudiada. Si a ello se agrega la circunstancia de que amplias zonas antes cubiertas por este tipo de vegetación se encuentran en la actualidad sosteniendo diferentes tipos de comunidades secundarias herbáceas y arbustivas, podrá comprenderse facilmente que los límites que se señalan en el mapa no constituyen en realidad sino una representación aproximada de los hechos naturales.

El factor climático de máxima importancia que limita la distribución del bosque tropical deciduo parece ser la temperatura, y en particular la temperatura mínima extrema, que no debe bajar o sólo excepcionalmente baja de 0°C. La isoterma correspondiente a esta temperatura no siempre sigue con fidelidad el recorrido de las curvas de nivel, pues existen sitios a más de 1500 m de altitud en los que aparentemente nunca hiela, y otros cerca de 1000 m sobre el nivel del mar con heladas en la mayor parte de los inviernos. Tal

circunstancia permite explicar, al menos en parte, por qué los límites altitudinales del bosque tropical deciduo se comportan a menudo de manera al parecer caprichosa. Este aspecto se discutirá también más adelante al describir el bosque de pino-encino.

Otro factor climático limitante es sin duda la humedad. El clima hídrico de la vertiente pacífica de México se caracteriza por una concentración muy acentuada de la precipitación en 4 a 5 meses, siendo seco todo el resto del año. Tal distribución es semejante al régimen monzónico, característico de ciertas áreas intertropicales del Antiguo Mundo, y no es de extrañarse la analogía en la vegetación, pues el llamado "bosque monzónico" de la India es comparable al bosque tropical deciduo.

Dada esta distribución de la precipitación, parece ser que todos los factores del medio ambiente que tengan que ver con la retención de la humedad, de manera que las plantas puedan disponer de ella durante una mayor o menor parte del período seco, deben ejercer mucha influencia sobre la distribución de las comunidades vegetales ahí. Las apariencias indican que el suelo profundo de los terrenos aluviales de relleno, cuando bien drenado, constituye un substrato menos favorable que el suelo somero y pedregoso de las laderas de los cerros, y mientras el último sostiene el bosque tropical deciduo, el primero alimenta en las mismas condiciones climáticas un tipo de vegetación de aspecto más xeromorfo, el bosque espinoso.

En áreas en que la precipitatión media anual es superior a unos 1000 mm el bosque tropical deciduo usualmente es substituido por el mucho más exuberante bosque tropical subdeciduo. En ninguna estación meteorológica situada dentro de los límites de la mitad suroccidental de Nueva Galicia la precipitación media anual es inferior a 600 mm, y si acaso existen zonas que reciben menos lluvia, éstas deben ser de extensión reducida. Gentry (1942: 14) calcula una precipitación anual de aproximadamente 500 mm como correspondiente al "short tree forest," que es el equivalente del bosque tropical deciduo en Sonora. De ser correcta tal estimación, debe tratarse del límite inferior de la tolerancia de este bosque, pues en otras partes de México 500 mm anuales en condiciones cálidas o semicálidas sólo son suficientes para el desarrollo de matorrales xerófilos, como "thorn-scrub" en Yucatán (Lundell, 1937: 7) o "matorral submontano" en San Luis Potosí (Rzedowski, 1965:135).

La temperatura media anual característica del bosque tropical deciduo suele ser del orden de 20 a 28° C, siendo las más calientes algunas depresiones interiores.

Los suelos son de naturaleza diversa, arenosos a arcillosos, ácidos a casi neutros, pobres o ricos en materia orgánica, pero siempre bien drenados, más o menos someros y generalmente pedregosos. No es frecuente la presencia de horizontes de endurecimiento.

El bosque tropical deciduo carece en la actualidad de mayor importancia forestal, y aunque muchos de los árboles se utilizan localmente para fines de construcción, como postes, combustible y algunos otros propósitos, no existen en la zona estudiada explotaciones forestales comerciales dentro de este tipo de vegetación. La influencia del hombre sobre este tipo de vegetación varía de un lugar a otro. En las zonas densamente pobladas grandes extensiones han sido completamente desmontadas y están bajo cultivo o cubiertas por comunidades secundarias de diversos tipos. Esto es muy notable por ejemplo en la barranca cerca de Guadalajara, en los alrededores de Autlán, de Ciudad Guzmán, etc. En las áreas menos sometidas a la presión demográfica la situación es generalmente mejor y muchas laderas se ven cubiertas aún por un manto ininterrumpido de bosque. Es de notarse, sin embargo, que casi en todas partes se encuentra ganado, y la mayoría de este territorio está sometida

a incendios periódicos más o menos intencionales y ligados con la cría de los animales. De manera que la estructura y la composición florística de muchas asociaciones del bosque tropical deciduo están modificadas en función de estos factores de disturbio permanente o periódico.

En estado natural o poco perturbado, el bosque tropical deciduo suele ser una comunidad vegetal densa, dominada por árboles de 8 a 15 m de alto, que forman un techo de altura más bien uniforme, pero no es raro encontrar un estrato adicional de eminencias aisladas. La copa de estos árboles tiende a ser convexa o plana y su diámetro con frecuencia iguala o sobrepasa la altura de la planta. El diámetro de los troncos rara vez excede de 50 cm. Las ramas parten por lo general desde la altura de 1 a 2 m y el eje principal pierde pronto su individualidad (Figs. 8, 9). Durante los 4 a 5 meses de la temporada lluviosa el bosque está cubierto de un follaje que de lejos se aprecia de color verde claro, mucho más claro que el propio del bosque tropical subdeciduo. El tamaño predominante de las hojas o foliolos es medianamente pequeño (categoría de nanófilas de la clasificación de Raunkiaer). Un gran número de plantas leñosas florece al finalizar la época seca, antes o al tiempo de la aparición de las hojas. Las plantas espinosas no son abundantes en el estrato arbóreo, aunque a veces alguna especie de cactácea columnar forma parte de la comunidad. Plantas con troncos cubiertos por corteza papirácea (*Bursera* spp., *Jatropha cordata*, *Pseudosmodingium perniciosum*) a menudo constituyen un elemento importante del bosque tropical deciduo en Nueva Galicia en altitudes intermedias, pero sólo rara vez llegan a dominar como en el caso de los "cuajiotales" de muchos sectores de la cuenca del Balsas (comp. Miranda, 1941) y de ciertas zonas del estado de Oaxaca.

Fig. 8. Bosque tropical deciduo, cerca de Tepalcatepec, Mich., con *Bursera trimera*, *Bursera fagaroides* y diversas leguminosas. (Fot. Rzedowski).

Aunque en algunas localidades se observa clara dominancia de una sola especie (*Lysiloma divaricata*), lo corriente es que 2 a 4, o a veces hasta 10 y más especies distintas compartan la preponderancia del estrato arbóreo. Por lo general suelen ser algunas de las siguientes:

Amphipterygium spp.
Bursera excelsa var. *favonialis*
Bursera fagaroides var. *elongata*
Bursera fagaroides var. *purpusii*
Bursera grandifolia
Bursera kerberi
Bursera multijuga
Bursera penicillata
Capparis incana
Capparis verrucosa
Ceiba aesculifolia
Comocladia engleriana
Cyrtocarpa procera
Forchhammeria pallida
Jatropha cordata
Lonchocarpus eriocarinalis
Lonchocarpus lanceolatus
Lysiloma acapulcensis
Lysiloma divaricata
Pseudosmodingium perniciosum
Spondias purpurea
Thouinia acuminata
Trichilia colimana
Trichilia palmeri

siendo casi siempre presentes alguna especie de *Bursera*, *Ceiba*, y *Lysiloma divaricata*.

Otros árboles más o menos frecuentes en el mismo estrato pueden ser:

Acacia acatlensis
Acacia macilenta
Agonandra racemosa
Albizzia tomentosa
Astronium graveolens
Bombax ellipticum

Fig. 9. Bosque tropical deciduo, cerca de Mezquitic, Jal. Destacan *Bursera* spp., *Amphipterygium* sp., *Lysiloma divaricata*. (Fot. Rzedowski).

Bombax palmeri
Bursera citronella
Bursera confusa
Bursera copallifera
Bursera denticulata
Bursera heteresthes
Bursera occulta
Bursera sarcopoda
Bursera aff. *simaruba*
Bursera trimera
Caesalpinia coriaria
Caesalpinia eriostachys
Carica mexicana
Cassia skinneri
Cephalocereus sp.
Erioxylum palmeri
Guaiacum coulteri
Jacquinia pungens
Jatropha curcas var. *rufus*
Jatropha peltata
Jatropha sympetala
Lasiocarpus sp.
Lemaireocereus sp.
Lysiloma tergemina
Morisonia americana
Pereskiopsis aff. *rotundifolia*
Piptadenia constricta
Plumeria rubra
Ruprechtia fusca
Tabebuia palmeri

Finalmente, hay varias especies arborescentes que parecen estar favorecidas por condiciones de disturbio:

Acacia cymbispina
Apoplanesia paniculata
Ateleia standleyana
Bunchosia palmeri
Bursera bipinnata
Caesalpinia platyloba
Cassia atomaria
Cassia emarginata
Cnidoscolus tepiquensis
Cnidoscolus tubulosus
Cochlospermum vitifolium
Colubrina triflora
Cordia alliodora
Cordia seleriana
Cordia sonorae
Crataeva tapia
Erythrina lanata
Ficus cotinifolia
Guazuma ulmifolia
Gyrocarpus americanus
Heliocarpus spp.
Ipomoea intrapilosa
Ipomoea wolcottiana
Ipomoea sp.
Leucaena glauca
Liabum caducifolium
Liabum glabrum var. *hypoleucum*
Lonchocarpus constrictus
Mastichodendron capiri
Physodium corymbosum
Pistacia mexicana
Randia cinerea
Randia sp.
Ruprechtia pallida
Sabal rosei
Sapindus saponaria
Sapium pedicellatum
Stemmadenia tomentosa var. *palmeri*
Thevetia ovata
Thevetia plumeriifolia
Trichilia hirta
Vitex mollis
Zanthoxylum aff. *arborescens*
Ziziphus amole

En el estrato de eminencias puede ser conspicua *Conzattia multiflora*, y hacia los lugares protegidos y cercanos a los cursos temporales de agua, *Enterolobium cyclocarpum*, *Ficus* spp. y diversos otros árboles propios del bosque tropical subdeciduo.

El techo del estrato arbóreo es a veces denso y entonces permite el crecimiento de esciófitas arbustivas o herbáceas, como:

Chamaedorea pochutlensis
Dorstenia drakena
Lasiacis divaricata
Lasiacis ruscifolia
Maranta arundinacea
Oplismenus rariflorus

pero lo mas frecuente es que bien en forma natural, o bien debido a la intervención del hombre, las copas de los árboles dejen pasar suficiente luz para el

establecimiento de un estrato arbustivo y otro herbáceo bien definidos, que con frecuencia constituyen un serio obstáculo para quien pretenda caminar a través de esta espesura.

Los arbustos más frecuentes de 1 a 3 m de alto suelen ser:

Acacia angustissima
Acalypha cincta
Acalypha filipes
Acalypha langiana
Acalypha vagans
Aeschynomene amorphoides
Agave sp.
Ayenia glabra
Ayenia pringlei
Bauhinia pringlei
Bromelia karatas
Bursera schlechtendalii
Capparis verrucosa
Casearia dolichophylla
Casearia pringlei
Chiococca alba
Cordia cana
Coursetia mollis
Croton flavescens
Croton fragilis
Croton pseudoniveus
Croton suberosus
Dalembertia populifolia
Diphysa suberosa
Erythroxylon mexicanum
Erythroxylon pallidum
Eugenia pleurocarpa
Euphorbia colletioides
Euphorbia schlechtendalii
Exostema caribaeum
Hamelia versicolor
Haplophyton cimicidum
Hintonia latiflora
Hintonia standleyana
Hyperbaena ilicifolia
Jacquinia aurantiaca
Jatropha peltata
Lagascea decipiens
Malpighia mexicana
Malpighia ovata
Nopalea sp.
Notoptera tequilana
Phyllanthus acuminatus
Phyllanthus mocinianus
Porophyllum punctatum
Pouzolzia palmeri
Recchia mexicana
Semeiandra grandiflora
Tabernaemontana amygdalifolia
Wimmeria persicifolia
Zexmenia ceanothifolia
Ziziphus mexicana

Entre las plantas herbáceas heliófitas se anotaron:

Acalypha sp.
Bouteloua repens
Cathestecum erectum
Desmodium sp.
Dyschoriste hirsutissima
Elytraria squamosa
Euphorbia heterophylla
Euphorbia humayensis
Florestina pedata
Henrya sp.
Hilaria ciliata
Hybanthus serrulatus
Notholaena brachypus
Opizia stolonifera
Oplismenus burmannii
Oxalis sp.
Podophania dissecta
Rivina humilis
Ruellia sp.
Setariopsis latiglumis
Tragoceros flavicomum
Tripsacum sp.

Las lianas usualmente no constituyen un elemento muy importante en la estructura del bosque tropical deciduo, habiéndose observado las siguientes en situaciones protegidas:

Adenocalymma calderonii
Ampelocissus acapulcensis
Doxantha unguis-cati
Entada polystachia
Exogonium bracteatum
Heteropteris laurifolia
Heteropteris palmeri
Hippocratea volubilis
Nissolia fruticosa
Paullinia sessiliflora
Paullinia tomentosa
Pithecoctenium echinatum
Saldanhaea seemanniana
Vitis tiliifolia

Diversas trepadoras más delicades, en cambio, pueden ser muy abundantes, por ejemplo representantes de:

Antigonon
Aristolochia
Dioscorea
Ipomoea
Marsdenia
Nissolia
Passiflora
Phaseolus
Quamoclit
Rhynchosia
Serjania

Entre las epifitas predominan francamente las especies del género *Tillandsia*, siendo más bien escasas las *Aráceas* y las *Orquidáceas*. Las anotadas fueron:

Selenicereus vagans
Tillandsia achyrostrachys var. *stenolepis*
Tillandsia ionantha
Tillandsia juncea
Tillandsia recurvata
Tillandsia schiedeana
Tillandsia tenuifolia

De los diferentes tipos de comunidades secundarias que se originan después de la destrucción del bosque tropical deciduo los más frecuentes son los bosquecillos o matorrales abiertos de *Acacia farnesiana* y de *A. pennatula*, acompañadas a menudo de numerosas especies herbáceas y de las siguientes arbustos:

Acacia hindsii
Alvaradoa amorphoides
Casearia pringlei
Cassia emarginata
Celtis iguanea
Croton ciliato-glanduliferus
Lantana spp.
Opuntia fuliginosa
Pisonia aculeata
Pithecellobium dulce
Triumfetta spp.
Zanthoxylum fagara

Cuando el desmonte no es completo, árboles espaciados propios de la comunidad pueden convivir con las especies características de los matorrales secundarios, en formas diversas. Cuando el terreno es perturbado en forma más o menos permanente y sometido a incendios, suele haber muchos espacios abiertos abundando las gramíneas y otras plantas herbáceas. Por el contrario, si después del desmonte se abandona la parcela sin intervenir posteriormente, un matorral denso se establece en poco tiempo y persiste durante muchos años, mientras se recupera el bosque y sus árboles característicos logran volver a adueñarse del terreno.

Es muy factible que ciertas áreas señaladas en al mapa adjunto como cubiertas por el matorral subtropical sostenían en épocas anteriores un bosque tropical deciduo como vegetación clímax. A este respecto véase la discusión introductoria correspondiente al matorral subtropical.

Fig. 10. La barranca del Río Grande de Santiago, al norte de Amatitán, Jal., vista hacia río abajo. En las laderas pendientes pueden observarse los restos del bosque tropical deciduo. (Fot. McVaugh).

BOSQUE ESPINOSO

Leopold (1950), en su mapa de la vegetación de México, marca la existencia de una angosta y practicamente contínua franja de esta formación a lo largo del litoral de Pacífico, de Nayarit a Guerrero. Como ya lo observó Turner (1960: 276), tal manera de interpretar constituye solamente una gruesa aproximación a la realidad. De hecho la distribución del bosque espinoso en la costa es dispersa y esporádica, pues en amplias extensiones el bosque tropical subdeciduo y el bosque tropical deciduo están en contacto casi directo con el mar. En otros sitios se intercalan manglares o palmares, y sólo en las áreas de terrenos aluviales de suelo fino, bien drenado y sin nivel freático elevado, que penetren tierra adentro y que estén sometidos a una precipitación media anual inferior a 800 mm, parece haber condiciones favorables para la existencia de bosque espinoso de tipo litoral. Las principales zonas de su desarrollo en la región bajo estudio se localizan en la llanura costera situada entre la Laguna de Cuyutlán y la desembocadura del río Coahuayana, lo que corresponde a la región de Tecomán, y en la llanura costera próxima a la población de Tomatlán.

Un bosque espinoso fisonómica y floristicamente análogo se ha encontrado también en áreas localizades en algunas depresiones interiores, especialmente en terrenos aluviales próximos al lecho del río Tepalcatepec, en la región limítrofe entre Jalisco y Michoacán, de donde fue descrito por Leavenworth (1946: 143-144) bajo el nombre de "arid scrub forest." De una asociación similar se han visto asimismo enclaves (que no se señalan en el mapa adjunto) en la depresión correspondiente a la cuenca alta del río Armería, entre Autlán y Ciudad Guzmán.

En el concepto de bosque espinoso se incluye en este trabajo otra comunidad vegetal, también de distribución irregular y esparcida. Es la que corresponde a los bosques de *Prosopis laevigata* y de *Pithecellobium dulce*, que probablemente ocupaban los suelos profundos, sin nivel freático elevado, dentro del área general del bosque tropical deciduo y del matorral subtropical. Los mezquitales (bosques de *Prosopis*) se conservan aún en algunos sitios impropios para la agricultura; no se ha visto la existencia de bosques de *Pithecellobium*, sólo se localizan árboles aislados en terrenos actualmente cultivados, de los que se presume que debieron haber sostenido el mencionado bosque antes de su desmonte. Debido a dificultades técnicas estas áreas no se cartografiaron como tales y en su mayoría quedan incluidas en las zonas del bosque tropical deciduo y del matorral subtropical (véanse las discusiones correspondientes).

Ambos tipos de comunidades considerados en Nueva Galicia como bosque espinoso deben interpretarse como clímax edáficos, puesto que sólo se desarrollan sobre suelos profundos y la vegetación sobre las laderas de cerros inmediatos es distinta y en general más exuberante. A este respecto cabe hacer la observación que en la planicie costera de Sinaloa y del sur de Sonora el bosque espinoso puede considerarse como clímax climático (Shreve, 1937; Gentry, 1942).

El bosque espinoso de la zona de Tecomán se encuentra actualmente en gran parte desmontado y las áreas que quedan presentan señales de disturbio fuerte. En la región de Tomatlán, en cambio, existen aún grandes superficies bastante bien conservadas y de ahí, al igual que del área del río Tepalcatepec, se tomó la mayor parte de los datos que sirvieron para la siguiente descripción.

Esta formación ocupa superficies planas o levemente inclinadas de suelo profundo, más bien arenoso y bien drenado, donde la precipitación media anual es del orden de 500 a 750 mm, con 7 a 8 meses de sequía. La altitud no pasa de 800 m y la temperatura es muy elevada, pues se registran valores de 25 a 29°C en escala media anual; las heladas se desconocen por completo.

El bosque es más o menos denso y suele estar formado por un sólo estrato arbóreo de 4 a 7 m de alto (Figs. 11, 12). Dominan árboles delgados que se ramifican desde niveles bajos, provistos de hojas o foliolos pequeños (en su mayoría de la categoría de nanofilia de la clasificación de Raunkiaer), los que son deciduos en la gran mayoría de los casos, por períodos variables de tiempo. Abundan en él sobremanera los elementos espinosos, incluyendo a veces algunas cactáceas. Las trepadoras y las epifitas son escasas, al igual que los elementos herbáceos.

No tiene importancia desde el punto de vista forestal y se aprovecha más bien para fines ganaderos, aunque con rendimientos escasos. El clima no permite cultivos sin riego, pero cuando éste existe, las condiciones cambian por completo y el bosque se convierte en zonas agrícolas importantes, como es el caso de muchos terrenos cercanos a Tecomán y Tepalcatepec.

En las zonas costeras los siguientes árboles se encontraron con mayor frecuencia:

Acacia cymbispina
Achatocarpus gracilis
Bursera instabilis
Caesalpinia coriaria
Celtis sp.
Croton alamosanus
Lemaireocereus sp.
Pithecellobium dulce
Ruprechtia fusca
Ruprechtia pallida
Ziziphus amole

Fig. 11. Bosque espinoso, cerca de Tomatlán, Jal. Destacan *Achatocarpus gracilis*, *Ruprechtia pallida*, *Podopterus mexicanus*, *Celtis* sp. (Fot. Rzedowski).

En cambio en las depresiones interiores se han visto con abundancia:

Acacia cymbispina
Amphipterygium glaucum
Caesalpinia coriaria
Caesalpinia platyloba
Cercidium praecox
Guaiacum coulteri
Haematoxylon brasiletto
Manihot tomatophylla
Mitrocereus militaris
Opuntia sp.
Pachycereus pecten-aboriginum
Podopterus mexicanus
Prosopis laevigata
Ruprechtia fusca
Ximenia americana
Ziziphus amole
Ziziphus mexicana

Otros árboles observados fueron:

Acacia farnesiana
Apoplanesia paniculata
Bumelia persimilis subsp. *subsessiliflora*
Bursera spp.
Caesalpinia cacalaco
Caesalpinia eriostachys
Capparis asperifolia
Capparis incana
Capparis sp.
Crataeva tapia
Crescentia alata
Cordia dentata
Cordia elaeagnoides
Forchhammeria pallida
Lysiloma tergemina
Morisonia americana
Pithecellobium lanceolatum

En el más bien escaso estrato arbustivo se anotaron:

Acanthocereus occidentalis
Bauhinia pauletia
Celtis iguanea
Diphysa suberosa
Erythroxylon sp.
Jacquinia aurantiaca

Fig. 12. Bosque espinoso, cerca de Tepalcatepec, Mich. Pueden observarse *Mitrocereus militaris*, *Cercidium praecox*, *Prosopis laevigata*, *Ziziphus amole*. (Fot. Rzedowski).

Jacquinia pungens
Karwinskia humboldtiana
Lagrezia monosperma
Randia spp.
Ruellia aff. *albiflora*

de los cuales *Acanthocereus* y *Celtis* hacen las veces de trepadoras. Entre las epifitas sólo se encuentran especies xerófilas de *Tillandsia*, pero *Struthanthus venetus* es un parásito común sobre árboles diversos. En el suelo a veces abundan *Bromelia* spp. lo suficiente para hacer difícil el paso.

En zonas cercanas a los lagos de Zacoalco y de Sayula, así como en un área extensa entre San Francisco del Rincón y Manuel Doblado, en Guanajuato, se han conservado bosques de *Prosopis laevigata*, pues el terreno se inunda con frecuencia y no es útil para la agricultura. Estos mezquitales forman una comunidad densa, de 5 a 10 m de alto; sobre las ramas de *Prosopis* a menudo abunda *Tillandsia recurvata*. Muy pocos elementos leñosos conviven con el mezquite; de los altos se han observado solamente *Celtis pallida*, *Lemaireocereus* sp. y *Opuntia fuliginosa*. En la época favorable abundan las plantas anuales.

Los pocos restos de vegetación natural indican que las tierras aluviales profundas de muchos sitios de Nueva Galicia sostenían una vegetación semejante. Es probable que a altitudes inferiores de 1600 m y en condiciones más favorables de humedad *Pithecellobium dulce* tambien era componente de estos bosques y quizás dominante a altitudes por debajo de 1000 m. Se requiere un estudio más profundo para reconstruir con mayor detalle la composición de la vegetación que anteriormente ocupaban estos suelos, hoy dedicados a la agricultura.

MATORRAL SUBTROPICAL

En su estudio sobre la vegetación de la parte SW del estado de Zacatecas, Guzmán y Vela Gálvez (1960: 54) aplicaron este nombre a un tipo de vegetación que caracterizaron como matorral, subtropical por su composición florística, y que se desarrolla entre las cotas de 1600 y 1800 m sobre el nivel del mar. La lista de especies incluye *Bursera* spp., *Ipomoea intrapilosa*, *Lemaireocereus* sp., *Myrtillocactus geometrizans* y algunas otras.

La denominación de "matorral subtropical" se empleará en el presente trabajo de manera provisional para incluir en ella un grupo algo heterogéneo de comunidades vegetales, una de las cuales es con seguridad la que Guzmán y Vela observaron y describieron. Es posible que estudios ulteriores más detallados requieran una modificación del concepto adoptado, cambiando el alcance del término, substituyéndolo por otro, o empleando quizás otra manera de clasificar estos matorrales y eliminando por completo el concepto abstracto aquí utilizado.

Una de las características sobresalientes de todas las comunidades que se pretende circunscribir como matorral subtropical es el hecho de que, hasta donde los autores pudieron observar, éstas están dominadas, por lo menos en gran parte, por especies que se conocen en otros sitios como indicadoras de disturbio o francamente propias de asociaciones secundarias. La dificultad, por otra parte, de considerar estos matorrales simplemente como secundarios estriba en la circunstancia de que ocupan un área muy extensa, y sobre todo porque en la mayoría de los casos no se ha podido encontrar un indicio claro de cual sería la formación clímax correspondiente, pues a pesar de haber dedicado tiempo y haber realizado viajes especiales no se ha localizado nada que fuera distinto en esencia y que pudiera considerarse como tal formación clímax existente. Debe advertirse al respecto que el área general de distribución geográfica del matorral subtropical corresponde en grandes superficies a una zona intensamente poblada desde hace muchos siglos y podría pensarse en ello como una posible causa de la destrucción de la vegetación primitiva.

De tratarse de un matorral secundario el razonamiento más viable iría en el sentido de postular el bosque tropical deciduo como formación clímax hipotética, al menos para una gran parte del área bajo consideración. En favor de ello se pronuncia sobre todo la composición floristica del matorral subtropical que se caracteriza por numerosos elementos comunes con el bosque tropical deciduo, como por ejemplo: *Bursera multijuga*, *B. penicillata*, *Lysiloma acapulcensis*, *Ceiba aesculifolia*, *Guazuma ulmifolia*, *Ipomoea intrapilosa*, *Heliocarpus terebinthaceus*, *Lemaireocereus* sp., *Jatropha cordata*, etc. Donde los dos tipos de vegetación se ponen en contacto la transición es muy gradual y existen numerosas localidades, en las cuales es difícil decidir a cual de las dos formaciones corresponde una vegetación determinada. El bosque tropical deciduo no se ha observado nunca en la zona estudiada por encima de 1700 m sobre el nivel del mar; el matorral subtropical, en cambio, que a menudo se desarrolla más arriba sobre las laderas del mismo cañón, alcanza muchas veces la altitud de 1900 m y en ocasiones de 2000 m. En algunas partes de la cuenca del río Balsas, sin embargo, el bosque tropical deciduo llega, según Miranda (1941: 572), hasta la cota de 1800 m. Es muy notable asimismo, que ni de la cuenca del Balsas (Miranda, 1947; Leavenworth, 1946), ni de Sinaloa o Sonora (Gentry, 1942, 1946a, 1946b) se cita nada semejante al matorral subtropical en las descripciones de la vegetación.

Como conclusión de este razonamiento podría suponerse que el bosque

tropical deciduo se extendía con anterioridad en Nueva Galicia tal vez hasta 1800 a 2000 m de altitud, pero por tratarse de una zona crítica en cuanto a las limitaciones climáticas, una vez destruido no puede recuperar facilmente el terreno perdido y está siendo substituido por el matorral subtropical, que por no ser una comunidad clímax se encuentra heterogénea y con aspecto de falta de equilibrio.

En favor de la otra alternativa (en apariencia opuesta), es decir de la posibilidad de considerar el matorral subtropical como un tipo de vegetación independiente, se pronuncian los argumentos siguientes:

1. Amplitud y continuidad de su área de distribución.
2. Correspondencia aparente con condiciones climáticas bien definidas.
3. En la porción oriental de México, hacia el área general de la Sierra Madre Oriental, entre Querétaro y Nuevo León, existe en condiciones climáticas muy semejantes un tipo de vegetación fisonómicamente análogo al matorral subtropical, que se ha descrito bajo los nombres de "piedmont scrub" (Muller, 1939) y de "matorral submontano" (Rzedowski, 1956). Este tipo de vegetación también es florísticamente similar al bosque tropical deciduo y posee un área de distribución bien definida, ocupando regiones un poco más frescas y un poco más áridas que las que corresponden al último tipo de vegetación. No hay ninguna duda de que el matorral submontano represente una formación clímax, aunque es de notarse que cuando se desarrolla sobre el substrato de roca ígnea, suele incluir muchas especies indicadoras de disturbio (comp. Rzedowski y Rzedowski, 1957: 51). A este respecto cabe hacer la observación que toda la extensión del matorral subtropical en Nueva Galicia corresponde al área de afloramiento de rocas volcánicas.

Por los motivos arriba expuestos los autores resolvieron conservar, al menos temporalmente, el concepto y el nombre de matorral subtropical, mientras investigaciones ulteriores puedan definir con mayor exactitud el lugar que corresponde al grupo de comunidades que se describen a continuación.

El matorral subtropical es el tipo de vegetación característico de la parte central del estado de Jalisco, extendiéndose al oriente hasta Michoacán y Guanajuato, y al norte hacia Zacatecas, Aguascalientes y quizás Nayarit. Su área contínua más extensa es la situada alrededor del Lago de Chapala y de un gran número de otras cuencas lacustres menores. Más al norte, su habitat preferente son las laderas de profundos cañones que caracterizan la región, ocupando una situación intermedia, por encima del piso del bosque tropical deciduo, pero por debajo del piso del bosque de pino-encino y del zacatal. Sus límites altitudinales se localizan por lo común hacia los 1600 y 1900 m, aunque en ocasiones se le encuentra unos 100 m más abajo o más arriba de las mencionadas cotas.

El clima correspondiente es sin duda más riguroso que el propio del bosque tropical deciduo, pues las heladas se presentan con regularidad, sin ser demasiado severas. Las temperaturas medias anuales son del orden de 17° a 21°C y la precipitación en promedio anual parece variar entre 500 y 900 mm. Las lluvias se concentran en un período de 4 a 5 meses (junio a octubre), mientras el resto del año resulta seco.

A semejanza del bosque tropical deciduo el matorral subtropical está restringido a suelos someros y pedregosos de las laderas de los cerros, siendo substituido en terrenos planos o poco inclinados por el bosque espinoso o por el zacatal. Como ya se indicó, el substrato geológico característico es el volcánico, predominando riolitas y andesitas, que producen por lo común un suelo más o menos arenoso, ácido y más bien pobre en materia orgánica.

El impacto de las activadades humanas se nota practicamente por dondequiera, bien en forma de desmontes, de la explotación de la leña, en forma de incendios y de cría de ganado. No se han podido observar lugares

completamente libres de algunas, al menos, de estas causas de disturbio. La ganadería y las actividades conexas son, sin embargo, las que más influencia parecen causar en la época actual.

Por su fisonomía el matorral subtropical puede ser una formación más o menos cerrada o abierta, dominada por arbustos altos o árboles pequeños de 3 a 5 m de alto (Fig. 13). La mayor parte de las plantas pierde sus partes verdes durante un período de 7 a 9 meses. Los arbustos espinosos pueden ser más o menos frecuentes, pero rara vez juegan el papel de dominantes. El tamaño de la hoja o foliolo es en promedio pequeño (categoría de nanofilia de la clasificación de Raunkiaer), aunque resultan notables algunos componentes de órganos foliares de tamaño relativamente grande, como *Annona longiflora*, *Heliocarpus terebinthaceus*, *Ipomoea* spp.

Un estrato de eminencias aisladas, de 6 a 12 m de alto, puede estar presente. Estos árboles son en general los propios del bosque tropical deciduo y quizás no representan sino restos del mismo:

Bursera copallifera
Bursera multijuga
Bursera palmeri
Bursera penicillata
Ceiba aesculifolia
Euphorbia fulva
Guazuma ulmifolia
Leucaena esculenta
Leucaena glauca
Lysiloma acapulcensis
Lysiloma divaricata

Sobre laderas rocosas verticales o casi verticales destaca a menudo el tronco amarillo de *Ficus petiolaris*, todo adherido al substrato.

En el estrato arbustivo principal las dominantes suelen ser comunmente una o varias de las siguientes especies:

Fig. 13. Matorral subtropical, cerca de San Juan Cozalá, Jal., con *Ipomoea intrapilosa*, *Acacia pennatula*, *Eysenhardtia polystachya*. (Fot. Rzedowski).

Acacia farnesiana
Acacia pennatula
Acacia sp.
Bursera fagaroides
Eysenhardtia polystachya
Forestiera phillyreoides
Forestiera tomentosa
Ipomoea intrapilosa
Ipomoea murucoides
Ipomoea sp.
Opuntia fuliginosa

Otros arbustos altos o arbolitos encontrados con más o menos frecuencia son:

Agonandra racemosa
Annona longiflora
Bursera bipinnata
Bursera schlechtendalii
Capparis incana
Celtis pallida
Colubrina triflora
Croton morifolius
Fouquieria formosa
Heliocarpus terebinthaceus
Jatropha cordata
Karwinskia humboldtiana
Lemaireocereus sp.
Liabum glabrum var. *hypoleucum*
Manihot caudata
Montanoa myriocephala
Montanoa pyramidata
Myrtillocactus geometrizans
Notoptera tequilana
Opuntia guilanchi
Pithecellobium acatlense
Plumeria rubra
Ptelea trifoliata
Randia watsonii
Sageretia elegans
Stemmadenia tomentosa var. *palmeri*
Viguiera quinqueradiata
Vitex mollis
Wimmeria confusa
Zanthoxylum fagara

El matorral subtropical está desprovisto de lianas conspicuas y entre las epifitas vasculares solamente destaca *Tillandsia recurvata*.

Un estrato arbustivo inferior (1 a 2 m) está por lo general bien desarrollado, de preferencia en las comunidades abiertas. De manera semejante, está compuesto en su mayoría de plantas de hoja pequeña y decidua. Entre las más características pueden mencionarse:

Agave aff. *pacifica*
Ayenia jaliscana
Asterohyptis stellulata
Bouvardia multiflora
Brickellia lanata
Bunchosia palmeri
Cordia cana
Cordia globosa
Cordia inermis
Cordia oaxacana
Croton adspersus
Croton ciliato-glanduliferus
Croton flavescens
Croton incanus
Eupatorium collinum
Hyptis albida
Hyptis rhytidea
Lagascea decipiens
Lantana camara
Lasiacis divaricata
Liabum pringlei
Mandevilla foliosa
Mimosa monancistra
Perymenium mendezii
Perymenium subsquarrosum
Porophyllum nutans
Tecoma stans
Triumfetta brevipes
Trixis angustifolia
Verbesina sphaerocephala
Zexmenia greggii
Zexmenia macrocephala

Las plantas herbáceas están bien representadas y forman en la época favorable del año un estrato más o menos contínuo, sobre todo en función de la superficie disponible del suelo, pues en las laderas muy inclinadas las rocas y las piedras no dejan mucho espacio entre sí.

Entre las perennes un lugar prominente corresponde a menudo a las gramíneas:

Andropogon spp.
Aristida spp.
Bouteloua curtipendula
Bouteloua filiformis
Cathestecum sp.
Hackelochloa granularis
Heteropogon contortus
Hilaria cenchroides
Muhlenbergia rigida
Muhlenbergia stricta
Paspalum spp.
Pentarrhaphis polymorpha
Rhynchelytrum roseum
Setaria geniculata
Sorghastrum incompletum

De las especies más frecuentes de hoja ancha cabe citar:

Acalypha ostryaefolia
Allionia choisyi
Ayenia spp.
Bogenhardia crispa
Bolanosa coulteri
Bouvardia ternifolia
Calea urticifolia
Cheilanthes kaulfussii
Cheilanthes myriophylla
Dalea tuberculata
Desmodium spp.
Euphorbia dentata
Euphorbia graminea
Euphorbia heterophylla
Euphorbia hirta
Euphorbia hyssopifolia
Euphorbia indivisa
Ipomoea stans
Iresine schaffneri
Jatropha dioica
Kallstroemia sp.
Lantana achyranthifolia
Lantana frutilla
Margaranthus solanaceus
Notholaena aurea
Notholaena sinuata
Pellaea ternifolia
Phaseolus heterophyllus
Polypodium thyssanolepis
Selaginella spp.
Tagetes lucida
Talinum paniculatum
Tetramerium sp.
Tradescentia crassifolia
Trixis longifolia

además de las trepadoras de los géneros:

Cardiospermum
Dioscorea
Ipomoea
Nissolia
Rhynchosia
Sechiopsis

Las anuales son también abundantes, como por ejemplo:

Aristida adscensionis
Bouchea prismatica var. *brevirostra*
Bouteloua barbata
Eragrostis spp.
Florestina pedata
Gomphrena decumbens
Heterosperma pinnatum
Melampodium spp.
Pectis prostrata
Priva mexicana
Sanvitalia procumbens
Tagetes elongata
Tragoceros schiedeanus
Tragoceros zinnioides
Zinnia peruviana

Entre las diferentes comunidades vegetales que se incluyen dentro del matorral subtropical merecen mención especial las siguientes:

En los alrededores del Lago de Chapala se presenta un matorral más o menos cerrado, de 3 a 5 m de alto, con *Ipomoea intrapilosa*, *Bursera bipinnata*, *B. fagaroides*, *Heliocarpus terebinthaceus*, *Acacia pennatula*, *Lemaireocereus* sp., *Acacia farnesiana*, *Fouquieria formosa*, *Tecoma stans*, *Eysenhardtia polystachya*, *Opuntia fuliginosa*, *Hyptis albida*, *Stemmadenia tomentosa* var. *palmeri*, con árboles aislados de *Lysiloma*, *Ceiba*, *Bursera multijuga*.

En el cañón de Juchipila (Zacatecas), en los alrededores de Calvillo y en otros lugares de la región de profundas barrancas al norte de Guadalajara, el matorral es también más o menos cerrado y mide por lo común 3 a 5 m de alto, entrando en su composición *Bursera fagaroides*, *Ipomoea* aff. *murucoides*, *Acacia* sp., *Mimosa monancistra*, *Opuntia streptacantha*, *O. fuliginosa*, *Myrtillocactus geometrizans*, *Eysenhardtia polystachya*, *Manihot caudata*, *Plumeria rubra*, *Lemaireocereus* sp., *Wimmeria confusa*, habiendo árboles aislados de *Bursera multijuga*, *Jatropha cordata*, *Lysiloma divaricata*, *Ceiba aesculifolia* y *Ficus petiolaris*.

Hacia la región de Jiquilpan y Zamora, en Michoacán, el matorral subtropical se presenta a veces bajo la forma de comunidad abierta, en aparente transición con el zacatal. Ahí predominan *Mimosa monancistra*, *Eysenhardtia polystachya*, *Forestiera phillyreoides*, siendo también abundantes *Acacia pennatula*, *A. farnesiana*, *Opuntia fuliginosa*, *Opuntia* sp., con árboles ocasionales de *Ceiba aesculifolia*, *Lysiloma acapulcensis* y *Bursera palmeri*.

En la región de Tepatitlán, Yahualica y San Juan de los Lagos, que parece estar dominada por el zacatal con *Acacia tortuosa*, en las laderas abruptas, en las pequeñas barrancas y cañones, los declives están cubiertos por un matorral de 2 a 4 m de alto, en que usualmente predominan *Eysenhardtia polystachya* con *Forestiera tomentosa*, *Acacia pennatula*, *Mimosa monancistra*, *Ipomoea murucoides*, *Opuntia fuliginosa*, *Hyptis albida*, *Acacia farnesiana*.

Como se señaló con anterioridad, tanto por su composición florística, como por su aspecto, la mayor parte de estas comunidades da la impresión de ser el resultado de un fuerte disturbio.

VEGETACION SABANOIDE

Miranda (1952: 116-123; 1958: 240-243) describió bajo el nombre de "sabana" una serie de asociaciones vegetales de Chiapas y de la Península de Yucatán, caracterizadas por ser "una agrupación constituida por extensas praderas de gramíneas, a veces con abundantes ciperáceas, y ordinariamente con árboles bajos dispersos, pero en ocasiones sin árboles." De las especies arbóreas más frecuentes se citan *Byrsonima crassifolia*, *Curatella americana*, *Crescentia alata* y *C. cujete*. El habitat característico está constituido por terrenos aluviales planos con deficiencia de drenaje, cenagosos durante una parte del año y con suelo muy seco en la otra temporada.

Leopold (1950) señala en su mapa de vegetación un área correspondiente a "savanna" situada en la planicie costera del sur de Sinaloa y del noroeste de Nayarit. Esta zona no ha sido estudiada por los autores y se halla fuera de los límites de Nueva Galicia. Otro pequeño manchón de "savanna" se localiza en el mencionado mapa en la región costera alrededor de Manzanillo. Es de presumirse que se trata de alguna confusión o quizás de error tipográfico, pues nada semejante a una sabana se ha podido localizar en ese sector. En otros dos sitios del estado de Colima, en cambio (1º cerca de Cerro de Ortega, municipio de Tecomán, dentro del área general del bosque espinoso, y 2º al este de la ciudad do Colima, en el área general del bosque tropical subdeciduo) se encontraron manchones de un bosquete abierto de *Crescentia alata* (Fig. 14), creciendo sobre suelo negro arcilloso y mal drenado, facilmente anegable

Fig. 14. Bosquete de *Crescentia alata*, cerca de Cerro de Ortega, Col. (Fot. Rzedowski).

con un buen aguacero. Algunos de los acompañantes de *Crescentia* en estos sitios son:

Acacia cymbispina
Acacia farnesiana
Achatocarpus gracilis
Amphipterygium glaucum
Bursera aff. *fagaroides*
Bursera palmeri
Caesalpinia cacalaco
Caesalpinia coriaria
Cassia skinneri
Coccoloba liebmannii
Cordia pringlei
Diphysa sp.
Pithecellobium sp.
Randia aff. *mitis*
Randia sp.
Thevetia aff. *ovata*
Trichilia trifolia

El suelo está cubierto en la época lluviosa por numerosas plantas herbáceas, pero no son abundantes las gramíneas altas, que deben caracterizar una sabana típica. Incuestionablemente se trata de un clímax edáfico.

Mucho más extendido que el anterior parece ser en Nueva Galicia otro tipo de comunidad vegetal, con semejanza fisonómica y florística a la sabana. Este se localiza sobre suelos someros derivados con frecuencia de rocas metamórficas, en laderas de cerros, a altitudes entre 400 y 800 m, en forma de manchones más o menos extensos, que en su conjunto constituyen quizás una franja estrecha pero casi continua desde Nayarit hasta Colima, y con probabilidad mucho más allá de estos límites, pues Gentry (1946b: 362) cita una comunidad en apariencia análoga bajo el nombre de "savanilla" de Sinaloa, y los autores la han observado en diversas localidades de Guerrero y Oaxaca. Miranda (com. pers.) la ha visto en las montañas de Oaxaca, próximas al Istmo de Tehuantepec.

Las gramíneas más o menos elevadas a menudo juegan un papel preponderante en esta comunidad y los árboles o arbustos característicos son:

Byrsonima crassifolia
Clethra rosei
Conostegia xalapensis
Curatella americana
Dodonaea viscosa
Miconia albicans
Quercus aristata
Quercus macrophylla
Vitex pyramidata

Byrsonima siempre se encuentra presente, muchas veces domina y en ocasiones puede constituir el único elemento arborescente; *Curatella* le sigue en frecuencia. Es muy notable la asociación con encinos, que en ocasiones es solamente de tipo de ecotonía, pero en varios sitios una o más especies de *Quercus* entran a formar parte de la comunidad, que en tales casos suele ser más cerrada y se convierte en un bosque bajo más o menos denso.

La sinusia epifítica puede estar compuesta por *Tillandsia balbisiana*, *Struthanthus* aff. *grahamii* y *Phoradendron commutatum*, este último un parásito algo frecuente de *Byrsonima*.

El número de especies herbáceas, que forman parte de la comunidad, puede ser elevado. Algunas de las encontradas son:

Aeschynomene amorphoides
Ageratum aff. *corymbosum*
Ageratum salicifolium
Andropogon brevifolius
Andropogon hirtiflorus
Aristida adscensionis
Aristida jorullensis
Aristida aff. *orizabensis*
Aristida aff. *ternipes*
Ayenia sp.
Borreria spp.
Bouteloua aff. *filiformis*
Bouteloua glandulosa
Bouteloua repens
Brickellia oliganthes
Buchnera pusilla

Bulbostylis capillaris
Bulbostylis aff. *vestita*
Cassia aff. *flexuosa*
Cassia hispidula
Cassia leptadenia
Cassia standleyi
Centaurium sp.
Coccocypselum hirsutum
Crotalaria sagittalis
Croton repens
Ctenium plumosum
Cuphea hookeriana
Cuphea lobophora
Cuphea llavea
Cynoctonum mitreola
Diectomis fastigiata
Diodia sp.
Elephantopus mollis
Elytraria squamosa
Eragrostis maypurensis
Euphorbia subreniformis
Euphorbia thymifolia
Evolvulus alsinoides
Heteropogon contortus
Lasiacis procerrima
Mexianthus mexicanus
Muhlenbergia speciosa
Ophryosporus sp.
Oplismenus burmannii
Oxalis hernandesii
Oxypappus seemannii
Panicum trichoides
Panicum sp.
Paspalum multicaule
Paspalum notatum
Paspalum plicatulum
Pectis dichotoma
Pennisetum setosum
Polygala angustifolia
Polygala longicaulis
Porophyllum punctatum
Pterolepis pumila
Russelia tepicensis
Salvia lasiocephala
Schultesia aff. *guianensis*
Sebastiania corniculata
Sida linifolia
Sida urens
Stylosanthes aff. *subsericea*
Tephrosia submontana
Trachypogon secundus
Turnera pumilea
Viguiera tenuis
Zexmenia macrocephala
Zinnia greggii
Zinnia maritima
Zornia diphylla

La abundancia de gramíneas crea condiciones favorables para la cría de animales y en efecto muchas de las áreas cubiertas por esta vegetación de tipo sabanoide se utilizan para tal fin y a menudo están sometidas a incendios periódicos. La existencia de evidentes pruebas de incendios podría hacer pensar que no se trata sino de una comunidad secundaria mantenida indefinidamente por el fuego, lo que de hecho puede ser verdad para ciertos sectores. Por otra parte, sin embargo, la curiosa distribución geográfica, unida al hecho de que se le ha visto en algunos sitios sin aparente huella de incendios, así como la correlación con un substrato geológico particular, sugieren más bien la idea de que la comunidad existía originalmente como clímax edáfico y que gracias al fuego pudo haber extendido su área de distribución.

Queda, desde luego, por dilucidar el determinismo ecológico preciso de la asociación que se acaba de describir, pues al tiempo de poseer las características de sabana, no se presenta sobre terrenos planos y con drenaje deficiente, que es el habitat típico de este tipo de vegetación (Beard, 1953; Miranda, 1958). Es de señalarse, sin embargo, que el mismo Beard (op. cit.: 159, 168-169) cita de Trinidad y de Cuba comunidades que clasifica dentro del conjunto de sabanas, que también vegetan sobre suelos bien drenados de laderas de cerros. La fotografía de la fig. 8 de la mencionada contribución de Beard que representa una "mountain savanna" con *Curatella* y *Byrsonima* de St. Joseph (Trinidad) ilustra una comunidad vegetal muy similar a las que pueden verse en la vertiente pacífica de México y su existencia sobre rocas metamórficas tampoco deja de ser significativa.

Fig. 15. Zacatal, cerca de Monte Escobedo, Zac. Destacan *Muhlenbergia rigida*, *Stevia serrata*. (Fot. Rzedowski).

ZACATAL

Este tipo de vegetación se distingue por la predominancia de plantas herbáceas de tipo graminiforme. Está representado en diversas zonas del área bajo estudio, pero es particularmente característico de la parte oriental, conocida con el nombre de los Altos de Jalisco, así como de porciones vecinas de Zacatecas, Aguascalientes y Guanajuato. El zacatal de esta región representa el extremo meridional de la extensa franja de *graminetum*, que arrancando desde el Canadá, abarca enormes superficies conocidas con el nombre de pradera (*prairies*) en la parte central de los Estados Unidos, y penetra hacia el sur por la Altiplanicie de México en forma de una cuña que corre al pie y a lo largo de la Sierra Madre Occidental (Shreve, 1942: 190-191).

En este zacatal, que presenta los rasgos de clímax climático, deben distinguirse por lo menos dos tipos fisonómica, florística y ecológicamente diferentes.

El primero es un zacatal típico, con participación escasa o casi nula de vegetación leñosa, muy semejante al que es común más al norte, en Durango y en Chihuahua. Predomina a menudo a altitudes generalmente mayores de 1900 m, que son frecuentes al noreste de Lagos de Moreno, al este de Aguascalientes y en ciertas áreas de Zacatecas y del extremo norte de Jalisco. Es característico de llanuras aluviales y de las que se extienden sobre mesetas riolíticas, pero cubre también con frecuencia laderas rocosas de cerros y sus abanicos aluviales. La precipitación anual es de 350 a 700 mm, con 6 a 7 meses secos. Las temperaturas medias anuales son del orden de 14 a 19° C, y se presentan en promedio anual 30 o más días con heladas. Son comunes los suelos de color claro, arenosos y moderadamente ácidos; a menudo se presentan horizontes endurecidos ferruginosos, a mayor o menor profundidad.

El pastoreo constituye el aprovechamiento económico más importante de las áreas cubiertas por el zacatal, y esta actividad, en apariencia, ha influido de manera notable modificando la composición y la estructura de la vegetación. En ciertas áreas de suelo profundo se practica también la agricultura, principalmente de temporal. En la mayor parte de los casos las cosechas son muy deficientes; los terrenos se abandonan pronto y es muy común encontrar comunidades vegetales secundarias en diferentes estados de sucesión.

Fisonomicamente, este zacatal tiene el aspecto de un césped monótono e ininterrumpido de gramíneas perennes más bien bajas, con sus partes aéreas amarillentas o parduzcas durante la mayor parte del año, y verdes durante la época lluviosa.

La densidad de la cubierta vegetal es muy variable y depende sobre todo de las condiciones edáficas y de la intensidad del pastoreo, pero, salvo áreas en que puede haber humedad edáfica adicional, las plantas no forman una carpeta continua y no son comunes las especies grandes amacolladas (Fig. 16).

La altura del zacatal, como es normal en un tipo de vegetación dominado por plantas herbáceas, es también variable en función de factores diversos. En años de precipitación abundante, durante la época de floración, las inflorescencias llegan a formar un estrato de 40 a 80 cm de alto (Fig. 15). En sitios protegidos de pastoreo las hojas de las gramíneas forman durante todo el año un estrato de 20 a 50 cm de alto, pero tales sitios son raros y lo que se encuentra casi siempre en época seca son macollas cortadas casi al ras del suelo, sobresaliendo a lo sumo unos 5 a 10 cm.

En condiciones óptimas del zacatal las plantas leñosas pueden faltar en su

totalidad, pero de hecho casi siempre se les encuentra, y su importancia aumenta de ordinario en función de ciertos tipos de disturbio, en función del aumento de la pendiente, y sobre todo en ecotonos con otros tipos de vegetación. Se trata por lo general de subarbustos o arbustos, pudiendo intervenir a veces pequeños árboles. Los componentes normales de las comunidades clímax parecen ser:

Acacia tortuosa
Agave filifera
Brickellia spinulosa
Bursera fagaroides
Cowania mexicana
Dasylirion parryanum
Echinofossulocactus sp.
Ferocactus melocactiformis
Forestiera phillyreoides
Helianthemum glomeratum
Jatropha dioica
Mammillaria spp.
Perymenium parvifolium
Pithecellobium leptophyllum
Prosopis laevigata
Yucca decipiens

Las especies siguientes se comportan comunmente como invasoras en terrenos perturbados. Es muy notoria la invasión por parte de *Opuntia*, que modifica de manera considerable la fisonomía de la comunidad.

Asclepias linaria
Baccharis ramulosa
Bouvardia ternifolia
Brickellia veronicifolia
Buddleia scordioides
Calliandra eriophylla
Dalea tuberculata
Dodonaea viscosa
Eysenhardtia polystachya
Haplopappus venetus
Mimosa biuncifera
Opuntia robusta
Opuntia streptacantha

Fig. 16. Zacatal de *Bouteloua gracilis*, cerca de Ojuelos, Jal. (Fot. Rzedowski).

Las especies dominantes en las comunidades son gramíneas perennes de tipo xeromorfo, con la mayor parte de las hojas en roseta basilar y de textura más o menos rígida, debida al parecer al alto contenido de sílice.

Bouteloua gracilis da la impresión de haber prevalecido en amplias extensiones en terrenos planos o poco inclinados y de suelo profundo, formando un zacatal moderadamente bajo, de 20 a 40 cm de altura. En la actualidad es más habitual encontrar como dominante *B. scorpioides*, especie cercana a la anterior, pero de menor altura y robustez. Otras gramíneas accompañantes de estas comunidades son: *Muhlenbergia rigida*, *M. repens*, *Aristida divaricata*, *A. schiedeana*, *Microchloa kunthii*, *Buchloe dactyloides*, *Lycurus phleoides*, *Bouteloua chondrosioides*, *Tripogon spicatus*.

En laderas más inclinadas, de suelo somero, el zacatal suele ser más alto, alcanzando hasta 0.8 m de altura, pero a menudo menos denso. La dominancia (frecuentemente compartida entre varias) puede ser de alguna de las siguientes especies: *Bouteloua curtipendula*, *B. gracilis*, *B. hirsuta*, *Andropogon hirtiflorus* var. *feensis*, *Aristida schiedeana*, *Muhlenbergia rigida*, *Heteropogon contortus*; siendo otras gramíneas a veces frecuentes: *Bouteloua filiformis*, *B. radicosa*, *Trachypogon secundus*, *Lycurus phleoides*, *Aristida divaricata*, *Tripsacum lanceolatum*. *Nolina watsonii*, una liliácea siempre verde de aspecto graminoide, se presenta en algunas localidades.

Un gran número de especies herbáceas perennes forma parte de estos tipos de zacatal, pero tal hecho sólo se pone de manifiesto en los años en que las lluvias son abundantes y oportunas. En años de precipitación escasa muchas de estas plantas no desarrollan, al parecer, sus partes aéreas. Son en su mayoría de estatura baja, muchas de ellas rastreras o semi-rastreras, en cambio las trepadoras son poco comunes. La siguiente lista sólo pretende incluir las más frecuentemente encontradas:

Fig. 17. Area de laderas abruptas cerca del Paso de las Trojes, entre Aguascalientes y Ojuelos. Al frente pueden observarse los árboles de una zona aluvial; al fondo destacan manchones de encinar arbustivo. (Fot. McVaugh).

Acacia hartwegii
Ageratum corymbosum
Allium kunthii
Astragalus hartwegii
Astragalus hypoleucus
Astragalus mollissimus
Bessera elegans
Bouchetia anomala
Bulbostylis juncoides
Cacalia sinuata
Calochortus barbatus
Commelina scabra
Cyperus seslerioides
Cyperus spectabilis
Dichondra argentea
Dyschoriste decumbens
Echeandia sp.
Eryngium heterophyllum
Euphorbia biformis
Euphorbia potosina
Euphorbia sphaerorhiza
Evolvulus alsinoides
Evolvulus prostratus
Evolvulus rotundifolius
Evolvulus sericeus
Gaudichaudia subverticillata
Hypoxis decumbens
Ipomoea costellata
Ipomoea stans
Kosteletzkya paniculata
Krameria secundiflora
Kyllinga odorata
Lotus oroboides
Macrosiphonia hypoleuca
Milla biflora
Nemastylis tenuis
Nothoscordum bivalve
Oxalis sp.
Perymenium rosei
Phaseolus heterophyllus
Pinaropappus roseus
Piqueria trinervia
Polianthes graminifolia
Polygala spp.
Sisyrinchium spp.
Spiranthes michuacana
Stenandrium sp.
Stevia micrantha
Stevia purpurea
Stevia serrata
Tagetes lucida
Tradescantia crassifolia
Valeriana ceratophylla
Viguiera linearis
Viguiera pachycephala
Zinnia angustifolia
Zornia diphylla

Las anuales, en su gran mayoría, son más bien indicadoras de terrenos sobrepastoreados o perturbados en otra forma. Aquí destacan entre otras:

Bidens spp.
Bouteloua simplex
Bulbostylis capillaris
Crusea sp.
Dalea spp.
Dyssodia papposa
Gomphrena decumbens
Heterosperma pinnatum
Loeselia coerulea
Monnina wrightii
Pectis prostrata
Tagetes micrantha
Zinnia peruviana

El segundo tipo de zacatal, que probablemente también constituye formación clímax, dada su gran extensión y las condiciones climáticas en que prospera, se localiza a altitudes entre 1700 y 2000 m, sobre todo en terrenos planos o algo inclinados, que abundan en el área entre Aguascalientes, León, Teocaltiche, Tecalitlán y Arandas. En diversas zonas del norte de Jalisco, así como en partes adyacentes de Zacatecas, se presenta a menudo ocupando extensiones más pequeñas y discontinuas, debido a la topografía quebrada de esa área.

Este tipo de zacatal se diferencia del anterior por la presencia constante de una especie leñosa, *Acacia tortuosa*, la que le presta una fisonomía muy peculiar, algo semejante a la de una sabana tropical de tipo africano (Fig. 18). Por sus gramíneas dominantes, este pastizal también es distinto del descrito más arriba.

Shreve (1942: 196-197), al discutir los zacatales del norte de México,

describe lo que denomina "cactus-acacia-grassland," formación que ha observado en el sur de Durango, en Zacatecas, en el norte de Jalisco y en el sur de San Luis Potosí, y que además de gramíneas y de *Acacia tortuosa*, se caracteriza por la predominancia de una especie de *Prosopis*, de *Opuntia streptacantha* y de *O. durangensis*.[1] El mencionado autor situa el "cactus-acacia-grassland" como un tipo de vegetación ecologicamente intermedio entre el zacatal y el matorral desértico ("desert").

Sería difícil negar que en algunos sitios de Aguascalientes y de Jalisco, y en muchos lugares del estado de Zacatecas existen terrenos cuya cubierta vegetal responde a la descripción de Shreve, pero el área total que ocupan no parece justificar su reconocimiento como formación, dentro del intrincado mosaico que forma la vegetación en toda esa región. Debe precisarse que en el suroeste de San Luis Potosí, en el sureste y en el centro de Zacatecas, en zonas adyacentes de Guanajuato y en ciertas áreas de Aguascalientes predomina sobre suelos derivados de rocas volcánicas el tipo de vegetación denominado "matorral crasicaule" (Rzedowski, 1957), caracterizado por la predominancia de cactáceas arbustivas (en especial *Opuntia streptacantha, O. leucotricha* y *Myrtillocactus geometrizans*), acompañadas de varias especies de leguminosas leñosas (véase p. 53). El papel de las gramíneas en estas "nopaleras" suele ser muy reducido y desde luego esta comunidad tiene poco en común florística y fisonomicamente con los zacatales, salvo las zonas de transición o áreas perturbadas con intensidad. El matorral crasicaule corresponde de hecho a la situación (esbozada por Shreve) ecologicamente intermedia entre el zacatal y el matorral desértico.

El zacatal con *Acacia tortuosa*, desde luego, es diferente por su ecología y con dificultad podría participar en la misma unidad fisonómica con el matorral crasicaule. Por consiguiente, en opinión de los que escriben, es más

Fig. 18. Zacatal con *Acacia tortuosa*, cerca de Lagos de Moreno, Jal. (Fot. Rzedowski).

conveniente considerar el "cactus-acacia-grassland" como un estadío de transición entre ambos tipos de vegetación mencionados, o bien como una variante del primero.

El zacatal con *Acacia tortuosa* existe en algunas regiones de Durango (Gentry, 1957: 73), no es raro en Zacatecas y Aguascalientes, pero alcanza su mejor desenvolvimiento en "los Altos" de Jalisco, donde constituye el elemento dominante del paisaje. Se le encuentra asimismo en localidades aisladas del suroeste de San Luis Potosí y en áreas restringidas de los estados de Hidalgo y México. Gentry sugiere que "su desarrollo puede estar relacionado con factores climáticos, como temperatura más elevada y mayor cantidad de luz" (en relación con el zacatal típico) y que "su presencia aquí (en Durango) parece anticipar mayores cambios vegetacionales hacia el trópico."

En cuanto a su clima el área del zacatal con *Acacia* es un tanto más cálida que la correspondiente a la primera variante, pues la temperatura media anual se mantiene entre 18 y 19° C. También en promedio anual llueve 500 a 800 mm; las heladas suelen concentrarse en menos de 30 días al año.

El suelo característico es en general profundo, de color gris o a veces rojizo, y predominantemente arenoso cuando derivado de rocas riolíticas, o más o menos arcilloso en zonas en que predominan basaltos. La presencia de horizontes de endurecimiento es frecuente.

El impacto de las actividades humanas sobre este tipo de zacatal también es muy notable. Hay grandes áreas dedicadas al cultivo, y la ganadería emplea los terrenos cubiertos por vegetación natural. El excesivo disturbio parece favorecer el establecimiento de arbustos y de especies anuales que desplazan las gramíneas dominantes.

El aspecto tan peculiar de *Acacia tortuosa* contribuye en buena medida a integrar la fisonomía de este pastizal. Se trata de un arbusto ó arbolito de 3 a 5 m de alto, con copa plana o casi plana y ramificaciones desde bastante abajo, recordando el conjunto la forma de un hongo. La mencionada especie es a menudo la única en el correspondiente estrato; la distancia promedio entre los individuos es por lo general superior a 7 m. No es rara la presencia de *Tillandsia recurvata* sobre las ramas de *Acacia*. Otras especies a veces existentes en el estrato arbóreo son las siguientes:

Acacia farnesiana
Eysenhardtia polystachya
Forestiera phillyreoides
Opuntia fuliginosa
Opuntia guilanchi
Opuntia streptacantha
Prosopis laevigata

Un estrato arbustivo de 0.5 a 1.5 m de alto en general se encuentra presente, aunque, salvo lugares perturbados, cubre escasa superficie. Pudieron observarse:

Baccharis ramulosa
Brickellia veronicifolia
Mimosa monancistra
Opuntia robusta

de las cuales *Mimosa* es la más constante y abundante.

En el estrato herbáceo suelen predominar dos especies de gramíneas perennes bajas (10 a 30 cm): *Bouteloua filiformis* e *Hilaria cenchroides*, y a menudo también una gramínea más elevada (40 a 80 cm), *Muhlenbergia rigida*. En ocasiones *Bouteloua gracilis* o *B. hirsuta* pueden prevalecer también, aunque es de presumirse que en condiciones originales *M. rigida* fue la especie más característica de toda esa área.

Otras gramíneas acompañantes pueden ser:

Andropogon barbinodis
Aristida adscensionis
Aristida divaricata
Bouteloua chondrosioides
Bouteloua radicosa
Bouteloua simplex
Buchloe dactyloides
Eragrostis spp.
Lycurus phleoides
Microchloa kunthii
Muhlenbergia repens
Rhynchelytrum roseum
Setaria geniculata
Tripogon spicatus

Las especies herbáceas perennes son numerosas y muchas alcanzan tallas de más de 50 cm. Su desarrollo está, como en el caso anterior, muy en relación con la incidencia y la abundancia de las lluvias. Pueden citarse entre las frecuentes:

Acalypha sp.
Astragalus mollissimus
Brayulinea densa
Buchnera sp.
Cacalia sinuata
Commelina scabra
Cyperus seslerioides
Dichondra argentea
Grindelia oxylepis
Hypericum sp.
Ipomoea stans
Nemastylis tenuis
Phaseolus heterophyllus
Piqueria trinervia
Polygala glochidiata
Stevia serrata
Stevia viscida
Tagetes lucida
Zornia diphylla

Las especies anuales son también abundantes y conspicuas, por ejemplo:

Gomphrena decumbens
Heterosperma pinnatum
Melampodium sericeum
Sanvitalia ocymoides
Schkuhria anthemoides var. *wislizenii*
Tagetes spp.
Zinnia peruviana

En la parte introductoria de este artículo se llama la atención del lector acerca del significado relativo de los límites entre los tipos de vegetación, tal como se señalan en el mapa adjunto. Esta precaución es muy aplicable al zacatal. Las áreas que se marcan como cubiertas por esta formación, en su mayoría constituyen de hecho un complejo mosaico, en el cual intervienen varios otros tipos de vegetación también. Pequeños manchones de encinar o de encinar arbustivo pueden encontrarse por dondequiera sobre eminencias topográficas, especialmente en exposiciones hacia el norte. Cerca de Lagos de Moreno y de Aguascalientes, así como en áreas situadas al oriente de estas poblaciones, muchas laderas abruptas, algunos abanicos aluviales y depresiones propias del sistema hidrográfico están cubiertas por el matorral crasicaule bien desarrollado y denso. Sobre algunas mesetas riolíticas en la misma área la abundancia de *Yucca decipiens* puede llegar a ser lo suficientemente grande para dar la impresión de un bosque abierto de *Yucca* con zacatal abajo. En la zona más baja hacia el suroeste de Aguascalientes y de Lagos de Moreno los sitios de topografía más abrupta suelen estar cubiertos por un matorral que siempre da la impresión de estar muy perturbado, y en el cual son conspicuos *Opuntia fuliginosa*, *Eysenhardtia polystachya*, *Mimosa monancistra*, *Acacia tortuosa*, *A. farnesiana* y algunos otros arbustos. Esta comunidad se describe más arriba con el nombre de matorral subtropical.

Reciprocamente, pequeñas extensiones de zacatal se intercalan de manera semejante entre otros tipos de vegetación en muchas partes de Nueva Galicia. En la mayoría de los casos se trata de comunidades seriales, de comunidades mantenidas por el fuego o de clímax edáficos. Se presentan, sin embargo, muchas situaciones dudosas, difíciles de comprender, y cuya correcta

interpretación ecológica requerirá estudios más profundos, tal vez experimentales.

Es en particular notable el caso de los pastizales bastante extensos de los alrededores de Guadalajara (a 1500-1700 m de altitud) y de los alrededores de Tepic (a 1000-1200 m de altitud). En ambas áreas el clima parece ser demasiado húmedo para la existencia de zacatal clímax y la cercanía de grandes centros de población sugiere el carácter secundario de estas comunidades. Por otra parte, en amplias áreas no se encuentra resto o indicio alguno de los posibles antiguos habitantes leñosos de la zona y el zacatal da la impresión de ser perfectamente estable. Las especies de gramíneas que con frecuencia se encuentran ahí son:

Andropogon condylotrichus
Andropogon hirtiflorus
Bouteloua curtipendula
Bouteloua gracilis
Bouteloua hirsuta
Bouteloua radicosa
Cathestecum erectum
Heteropogon contortus
Heteropogon melanocarpus
Muhlenbergia grandis
Muhlenbergia rigida
Muhlenbergia robusta
Muhlenbergia stricta
Paspalum spp.
Pentarrhaphis polymorpha
Rhynchelytrum roseum
Sorghastrum incompletum
Trachypogon secundus
Tristachya avenacea

Zacatales secundarios pueden encontrarse como claros en medio del bosque de pino o de encino, en medio del bosque tropical deciduo o del bosque espinoso. Se trata, por lo común, de áreas que hace poco fueron desmontadas y que regresan con lentitud hacia la condición boscosa natural, o más a menudo de áreas en las cuales el pastizal se mantiene artificialmente mediante incendios periódicos.

Los zacatales edáficos en la región estudiada son de dos tipos: los propios de suelos salinos y los que se discuten bajo el nombre de vegetación sabanoide en otro apartado de este trabajo.

Los característicos de suelos con exceso de sales solubles presentan una distribución muy restringida, pues se limitan en esencia a los fondos de algunas cuencas cerradas, en donde existen lagunas salobres más o menos intermitentes. Este es el caso de los lagos de Sayula y de Zacoalco, entre Guadalajara y Ciudad Guzmán, con franjas anulares angostas de zacatal bajo de *Distichlis spicata* con *Sporobolus pyramidatus*, *Scirpus americanus* y *Eragrostis obtusiflora*, y varias especies anuales, a menudo entremezclado con manchones de bosquecillos de *Prosopis* con *Opuntia* y *Celtis pallida*.

Otra comunidad vegetal dominada por gramíneas, también de área muy definida y pequeña, es la que se presenta por encima del límite de la vegetación arbórea. Para su descripción véase la pág. 66.

MATORRAL CRASICAULE

Este tipo de vegetación descrito por Rzedowski (1955, 1957) ocupa importantes superficies en el centro y sureste de Zacatecas así como en el suroeste de San Luis Potosí y partes de Guanajuato, con enclaves en Aguascalientes y en el extremo nororiental de Jalisco.

En la región bajo estudio no cubre muchas extensiones continuas, sino se presenta en forma de manchones, generalmente rodeados por el zacatal, y en ciertas partes forma amplias fajas de transición con el zacatal, que se discuten en el inciso correspondiente a ese tipo de vegetación.

El matorral crasicaule es una formación de aspecto xeromorfo, con predominancia de cactáceas arbustivas o arborescentes, acompañadas de leguminosas espinosas, formando una cubierta casi siempre más cerrada que la mayoría de los matorrales desérticos, pero sin que muchos de los arbustos individuales del estrato superior se toquen entre sí y sin ofrecer mayor obstáculo al paso del hombre o del ganado (Fig. 19). Por su situación ecológica el matorral crasicaule ocupa un sitio intermedio entre los matorrales desérticos y el zacatal, pues convive con ambos en muchas regiones.

Tipicamente se presenta sobre suelos someros derivados de rocas volcánicas de laderas de cerros, cañones o depresiones, pero también se le observa a veces sobre llanuras y entonces puede adquirir en la región estudiada el aspecto de "cactus-acacia-grassland" (véase la discusión en el inciso correspondiente al zacatal). Sus límites altitudinales se localizan en Nueva Galicia cerca de los 1800 y 2200 m, y la precipitación media anual de las localidades que incluye varía entre 350 y 550 mm.

Fig. 19. Matorral crasicaule, cerca de Aguascalientes, Ags., con *Opuntia streptacantha*, *Opuntia guilanchi*, *Mimosa monancistra*, *Eysenhardtia polystachya*. (Fot. Rzedowski).

Economicamente el matorral crasicaule es interesante por sostener una ganadería mediocre o a veces vigorosa y por el aprovechamiento del fruto de *Opuntia streptacantha* ("tuna cardona"), que es comestible y altamente apreciado.

En la fisonomía de este tipo de vegetación las cactáceas juegan un papel de primera importancia, proporcionándole un aspecto peculiar y un verdor perenne. Las leguminosas, así como la mayor parte de otros componentes, son de hoja decidua, aunque algunos (como *Prosopis*) sólo por un periodo breve.

El estrato dominante suele medir 3 a 5 m de alto, siendo siempre importante en él *Opuntia streptacantha*. Otros arbustos codominantes ó más ó menos frecuentes pueden ser:

Acacia tortuosa
Aloysia ligustrina
Baccharis ramiflora
Cassia wislizenii
Celtis pallida
Eysenhardtia polystachya
Karwinskia humboldtiana
Lemaireocereus sp.
Opuntia guilanchi
Opuntia leucotricha
Opuntia robusta
Prosopis laevigata
Trixis angustifolia
Verbesina serrata
Yucca decipiens

Tillandsia recurvata no es rara sobre las ramas de *Prosopis* y a veces también sobre *Opuntia*.

Un estrato subarbustivo es muy conspicuo y con frecuencia cubre más superficie que el anterior. Sobresalen en él:

Brickellia veronicifolia
Calliandra eriophylla
Gymnosperma glutinosum
Haplopappus venetus
Mimosa biuncifera
Mimosa monancistra
Parthenium incanum
Zaluzania augusta

El estrato herbáceo tiene buen desarrollo en los años más húmedos, pero sólo por un periodo de 3 a 4 meses. Las gramíneas son relativamente poco importantes, en especial sobre suelos someros. Entre las diversas especies pueden citarse:

Perennes:

Ageratum corymbosum
Bahia absinthifolia
Boerhaavia spp.
Bouteloua chondrosioides
Bouteloua curtipendula
Bouteloua gracilis
Dyssodia setifolia
Enneapogon desvauxii
Froelichia interrupta
Leptochloa dubia
Lycurus phleoides
Muhlenbergia rigida
Plumbago pulchella
Setaria geniculata
Stipa eminens

Anuales:

Allionia choisyi
Aristida adscensionis
Bouchea prismatica
Bouteloua aristidoides
Chenopodium graveolens
Chloris virgata
Dyssodia cancellata
Dyssodia papposa
Eragrostis cilianensis
Euphorbia dentata
Euphorbia potosina
Euphorbia stictospora
Franseria sp.
Gomphrena decumbens
Kallstroemia sp.
Muhlenbergia tenuifolia
Parthenium bipinnatifidum
Pectis prostrata
Salvia reflexa
Zinnia peruviana

BOSQUE DE PINO Y ENCINO

Los pinares y los encinares constituyen la vegetación característica de las montañas de todo México. Según Leopold (1950: 509) ocupaban en épocas anteriores más del 25% del territorio de la República, y si bien esta extensión puede ser un poco exagerada, no se puede dejar de observar que, al lado de los bosques tropicales y de los matorrales desérticos, ocupan un lugar preponderante en la caracterización del paisaje mexicano. En general, el área de distribución de los bosques de pino y encino corresponde con la zona climática subhúmeda que en el país se conoce con el nombre de "tierra templada," a diferencia de "tierra caliente," cubierta por lo general por vegetación de tipo tropical. Este tipo de clima (aproximadamente Cw de la clasificación de Koeppen) tiene distribución muy vasta en la República y a sus numerosas variantes corresponden otras tantas de los bosques de pino y encino, que en su conjunto constituyen una unidad ecológica amplia y heterogénea, pero no del todo mal definida. Además, en las áreas de clima ligeramente más árido y algo más húmedo pueden existir también pinares y encinares, aunque por lo común fisonomicamente distintos de los típicos, y que en la literatura han recibido los nombres de "chaparral," "encinar arbustivo," "piñonar," "cloud forest," bosque deciduo templado," "bosque deciduo," "bosque mesófilo de montaña," etc. La nota aparentemente más "discordante" corresponde a estos restringidos tipos de encinares y pinares que penetran a la "tierra caliente" y se desarrollan al lado de los bosques tropicales; su existencia ahí parece estar ligada a ciertas condiciones edáficas peculiares, aún poco conocidas.

En otro trabajo uno de los autores (Rzedowski, 1965) discute los inconvenientes y la necesidad de mantener por el momento las diferentes clases de pinares y encinares (del estado de San Luis Potosí) en un sólo tipo de vegetación. En el caso de Nueva Galicia subsiste el mismo problema y la situación resulta aún más complicada. Debido a su escasa representación y a los diferentes estados intermedios no parece práctico distinguir por separado a nivel de tipo de vegetación los bosques de *Cupressus*, los de *Juniperus*, los de *Pinus cembroides*, los de *Alnus*, los encinares arbustivos de *Quercus potosina* y de *Q. macrophylla*, ni tampoco los encinares de bajas altitudes. Al reunir, sin embargo, todas estas comunidades con el ya bastante diverso "bosque de pino y encino" los autores se dan cuenta de que crean una unidad algo difícil de definir fisonómica, ecológica y florísticamente, por indudables que sean sus relaciones de una u otra índole. Sólo al bosque de oyamel y al bosque mesófilo de montaña se ha decidido mantener como tipos de vegetación independientes.

Resulta cada vez más necesario un estudio profundo y extensivo de los diferentes tipos de comunidades forestales de la altas montañas de México, con la mira de establecer bases firmes para su debida clasificación. Es factible, tal vez, que investigaciones ulteriores más pormenorizadas, llevadas a cabo dentro de la misma Nueva Galicia permitirán obtener una definición mejor y separación de varios tipos de bosques, aquí incluidos bajo el amplio concepto de "bosque de pino y encino."

Habiendo en la región estudiada numerosas sierras y sierritas discontinuas, el área de distribución del bosque de pino y encino se presenta a menudo forma de manchones aislados de tamaño diverso, muchos de los cuales se han tenido que eliminar por completo del mapa por representar superficies demasiado reducidas. El resto se concentra en dos zonas continuas de mayor extensión: la primera se localiza en la parte occidental de Jalisco, en el área

situada al oeste de Cocula, al norte de Autlán, al este del Cabo Corrientes y al sur de Compostela; esta zona está unida a través de corredores estrechos con otras dos áreas importantes, la del macizo del Nevado de Colima y la de las sierras altas entre Autlán, Manzanillo y Colima; la segunda comprende amplio territorio en la Sierra Madre Occidental, en el norte de Jalisco y en Nayarit, con prolongaciones hacia Zacatecas y Durango. Existen numerosos manchones más o menos extendidos en Nayarit, en las partes central y meridional de Jalisco y en secciones adyacentes de Michoacán. Partiendo del área general del Lago de Chapala hacia el noreste y hacia el este, en cambio, el tipo de vegetación se vuelve cada vez más escaso, en especial en la región de los Altos de Jalisco.

Se desarrolla con preferencia en altitudes entre 1000 y 4000 m, donde alcanza el límite de la vegetación arbórea, pero en las montañas cercanas al litoral puede descender hasta 300 m sobre el nivel del mar. Cabe observar que los límites altitudinales de los pinares son algo distintos que los de los encinares en Nueva Galicia, pues mientras los primeros vegetan entre 800 y 4000 m sobre el nivel del mar, el intervalo para los segundos queda aproximadamente entre 300 y 2800 m.

En tales condiciones es difícil discutir los requerimientos térmicos de esta formación, pero cabe hacer la observación que, si se exceptúa el área de los declives hacia la costa donde el encinar sin duda se encuentra en condiciones climáticas propias de los bosques tropicales, sus límites altitudinales inferiores parecen seguir muchas veces una línea que separa hacia abajo el área libre de heladas. Desafortunadamente no se cuenta con suficientes estaciones meteorológicas para poder estar seguro de la existencia de esta correlación. Cerca de la cumbre del Nevado de Colima el pinar soporta un clima en

Fig. 20. Pinar de *Pinus oocarpa*, con *Cupressus* y *Quercus*, en la Sierra de Manantlán, cerca de Autlán, Jal. (Fot. McVaugh).

que se presentan heladas durante todo el año y en ocasiones puede nevar; la temperatura media anual a nivel de la cota de 4000 m puede calcularse de unos 5°C (García, 1964).

El régimen de precipitación pluvial es semejante al que se describió para

Fig. 21. Encinar de *Quercus acutifolia, Quercus castanea, Quercus* sp., cerca de Autlán, Jal. Pueden observarse pinos jóvenes, y troncos cortados de pinos grandes. (Fot. McVaugh).

otros tipos de vegetación, es decir las lluvias se concentran en 5 meses y el periodo restante es de sequía. La cantidad mínima de precipitación necesaria para la existencia del pinar o encinar varía, de acuerdo con varios factores, entre ellos la altitud, pues mientras en la región limítrofe con San Luis Potosí, a unos 2300 m se requieren por lo menos 400 a 500 mm anuales para el encinar arbustivo o piñonar (Rzedowski, 1965: 175, 182), en la parte central de Jalisco, a altitudes entre 1400 y 1800 m, parece necesitarse cerca del doble de esta cantidad para la existencia de encinares o pinares de tipo arbóreo. Es posible que algunas regiones cubiertas por pinares reciban 1500 mm anuales o más, pero ninguna estación meteorológica establecida registra esta cantidad, en promedio.

La mayor parte de la superficie cubierta por este tipo de bosque se caracteriza por el substrato geológico de naturaleza ígnea, aunque hacia el occidente se presentan también a menudo rocas metamórficas. Suelos arcillosos rojos son frecuentes en la zona, pero tampoco son raros los suelos arenosos muy ácidos derivados de riolitas e inclusive arenas casi puras procedentes de la descomposición de granito. Salvo en las áreas de los encinares arbustivos, no se han encontrado horizontes notables de endurecimiento. Este tipo de vegetación se localiza siempre sobre suelos bien drenados, someros o profundos, aunque estos últimos en su mayor parte se encuentran dedicados a la agricultura.

Se dedican o se han dedicado a la agricultura en otros tiempos, asimismo, muchos terrenos sobre laderas, ocasionando una disminución del área boscosa, pues después del desmonte el pastoreo, los incendios, la erosión del suelo y el desequilibrio biótico causado impiden con frecuencia la recolonización del terreno por plantas arbóreas, una vez abandonada la agricultura. La ganadería constituye en la época actual el aprovechamiento principal de la mayor parte de las extensiones cubiertas por el bosque de pino y encino (especialmente de los primeros), en las cuales se favorece y se estimula el crecimiento de la cubierta herbácea mediante incendios periódicos. A pesar de existir amplias zonas susceptibles en apariencia de explotación maderera, ésta es más bien limitada y no se ha visto ningún sector boscoso importante, en que pudiera observarse el empleo de prácticas silvícolas. Es muy desconsolador ver en Jalisco centenares y centenares de kilómetros cuadrados de bosques carentes por completo de plantas arbóreas jóvenes y destinados por consiguiente a desaparecer, a sabiendas que estos bosques debidamente aprovechados y manejados podrían constituir una fuente permanente de riqueza y prosperidad para los habitantes de la región.

El área de pinares y encinares en Nueva Galicia va disminuyendo rapidamente; de no tomarse medidas para impedirlo seguirá disminuyendo hasta quedar reducida a las escasas porciones en que la reproducción natural del bosque es tan pujante, que puede realizarse a pesar de las actividades humanas.

Fisonomicamente, el tipo de vegetación puede presentarse bajo formas diversas, pues por principio de cuentas los pinares suelen tener un aspecto exterior y una estructura interior bien distintos de los encinares. Existen, sin embargo, muy frecuentes situaciones mixtas e intermedias, y las dos clases de bosque con sus diversas variantes entran a menudo en un mosaico complejo, que requerirá estudios a nivel de asociación antes de ser debidamente comprendido.

Los pinares suelen formar una comunidad de 10 a 20 m de alto (aunque algunos pueden estar un poco fuera de estos límites), cerrada ó por lo común semi-cerrada y en ocasiones abierta, aunque quizá a causa de disturbio. Los troncos de los pinos en lo general son derechos y altos y se ramifican sólo en la parte alta, formando una copa más o menos hemisférica. El estrato

dominante es siempre verde, aunque no necesariamente así el sotobosque, que a menudo presenta un aspecto desolado en la temporada seca. En muchos pinares el estrato arbustivo es apenas perceptible y en ocasiones sólo hay árboles y vegetación herbácea, en la cual de ordinario predominan gramíneas

Fig. 22. Pinar de *Pinus oocarpa*, en la Sierra de los Corales, cerca de Jilotlán, Jal. (Fot. Rzedowski).

amacolladas. Es posible que tal situación sea el resultado del pastoreo y de los incendios, pero en muchos casos con seguridad es natural.

Loock (1950: 28-29) cita no menos de 14 especies y varias variedades como componentes de los pinares de la zona estudiada. De ser correcto tal dato muchos de estos taxa deben tener una distribución más bien dispersa, pues las grandes masas forestales parecen estar formadas por un número más reducido de especies.

A altitudes entre 1000 y 2500 m la especie más ampliamente distribuida y en general dominante es *Pinus oocarpa*, acompañada a menudo de *P. michoacana* (Figs. 20-22), y a veces de *P. douglasiana* y *P. leiophylla*. En la zona del Nevado de Colima y en el área del Cerro Tancítaro los pinares son un poco más variados, pues *P. pseudostrobus*, *P. montezumae* y *P. ayacahuite* pueden ser más o menos abundantes hasta altitudes de 3000 m. De este nivel aproximado hasta el límite de la vegetación arbórea suele predominar *P. hartwegii* (Fig. 25).

Pinus lumholtzii y *P. chihuahuana* a veces forman bosquecitos más bien bajos y ralos en el área general de clima más árido, sobre todo en Zacatecas, Aguascalientes y partes adyacentes de Jalisco. Hacia la zona de los zacatales de los alrededores de Ojuelos, Lagos de Moreno, y de Huejuquilla, en cambio, existen pequeños manchones de piñonar de *P. cembroides*, comunidad también baja y poco cerrada.

De entre los encinares los más característicos y extendidos en Nueva Galicia son los de *Quercus macrophylla*, que se presentan en casi todas las áreas señaladas en el mapa como cubiertas por el bosque de pino y encino. Esta asociación es difícil de confundir con cualquier otra y puede distinguirse a distancia gracias a la especie dominante que posee hojas de tamaño grande,

Fig. 23. Encinar de *Quercus macrophylla*, cerca de Huejuquilla El Alto, Jal. (Fot. Rzedowski).

de color verde oscuro en el haz y amarillento-grisáceo en el envés; el conjunto de hojas refleja la luz de manera muy especial. Los encinares de *Quercus macrophylla* ocupan usualmente los habitats más secos dentro de las condiciones climáticas propias del bosque de pino y encino, pero no siempre se comportan así, pues hacia la región costera colindan con el bosque tropical subdeciduo y se mezclan con el bosque mesófilo de montaña. En la mencionada zona descienden a veces hasta altitudes de 300 m; en la parte central de Jalisco y en Zacatecas, en cambio, pueden dominar hasta 2600 m sobre el nivel del mar. En fisonomía y estructura tampoco son uniformes, ya que varían desde matorrales de 3 a 5 m de alto, densos o espaciados, propios de la parte noreste de Jalisco, Aguascalientes y Zacatecas, pasando por la forma más característica de bosque bajo y denso de 6 a 10 m de alto (Fig. 23), hasta bosques densos y oscuros de 15 a 20 m de alto, en las montañas próximas a la costa.

Otros encinares de tipo xerófilo y más bien arbustivos son los dominados por *Quercus depressipes*, *Q. grisea*, y *Q. potosina*, que se localizen en Aguascalientes y en el extremo noreste de Jalisco hacia los límites con San Luis Potosí. Forman matorrales o bosquecillos densos de 3 a 5 m de alto, a menudo difíciles de penetrar. A veces *Quercus eduardi* y *Q. coccolobifolia* forman parte de la asociación.

Del lado más húmedo, a altitudes inferiores (400 - 1400 m) en Nayarit y en el área próxima al litoral de Jalisco son frecuentes los bosques de *Quercus* aff. *aristata* y *Q. planipocula*, entremezclándose a menudo con los matorrales y bosquetes de tipo sabanoide de *Byrsonima* y *Curatella*.

A mayor altitud, entre 1500 y 2500 m, en condiciones favorables de humedad, no son raros en Jalisco los bosques de *Quercus obtusata*, de 10 a 20 m de alto, así como los de *Q. mexicana*, un poco más bajos. *Q. rugosa*, *Q. laurina* y

Fig. 24. Encinar de *Quercus* spp., cerca de Monte Escobedo, Zac. (Fot. Rzedowski).

Q. candicans pueden en ocasiones ser dominantes, pero más a menudo se presentan en compañía de otros árboles. (Fig. 24).

Los autores no han tenido la oportunidad de observar todos los tipos de encinares en la época seca, pero es seguro que en su mayoría (y probable que todos) sean de hoja decidua. Los árboles permanecen sin follaje por un período corto, por lo común de unas cuantas semanas anteriores al comienzo de la temporada lluviosa. Casi todos los encinos dominantes se caracterizan por sus hojas de tamaño mediano o grande, de textura coriácea, a menudo francamente gruesas.

Además de los mencionados, los siguientes árboles pueden ser más o menos abundantes en los bosques de pino y encino:

Alnus jorullensis
Arbutus glandulosa
Arbutus xalapensis
Befaria mexicana
Clethra spp.
Cupressus lindleyi
Juniperus deppeana
Juniperus flaccida
Quercus castanea
Quercus crassifolia
Quercus elliptica
Quercus gentryi
Quercus glaucoides
Quercus laxa
Quercus salicifolia
Rhamnus mucronata

y hacia las orillas de los arroyos pueden encontrarse con alguna frecuencia:

Alnus arguta
Buddleia cordata
Bursera spp.
Ficus cotinifolia
Fraxinus uhdei
Garrya laurifolia
Ilex brandegeana
Inga eriocarpa
Juglans major var. *glabrata*
Prunus serotina
Salix bonplandiana
Salix chilensis
Viburnum elatum
Vitex mollis

En algunos lugares *Cupressus lindleyi* y en otros *Juniperus* spp. pueden ser localmente dominantes o exclusivos en el bosque, pero en Nueva Galicia estas comunidades son raras y ocupan áreas muy reducidas.

El desarrollo del estrato arbustivo varía mucho de una asociación a otra y de una localidad a otra, siendo por lo general mayor en los encinares que en los pinares, aunque se dan también situaciones contrarias. En su mayoría son arbustos de hoja decidua, con follaje resistente a las heladas pero no a la sequía.

A partir de altitudes cercanas o a veces algo inferiores a 1000 m hacia arriba, los siguientes pueden ser frecuentes, especialmente en situaciones menos húmedas:

Arctostaphylos angustifolia
Arctostaphylos polifolia
Arctostaphylos pungens
Arthrostylidium longifolium
Arthrostylidium racemiflorum
Baccharis thesioides
Brickellia spp.
Buddleia parviflora
Calea urticifolia
Calliandra houstoniana
Calliandra palmeri
Cercocarpus macrophyllus
Chusquea sp.
Croton repens
Cunila spp.
Dasylirion sp.
Desmanthodium fruticosum
Desmodium jaliscanum
Desmodium plicatum
Eupatorium areolare
Eupatorium bertholdii var. *stenophyllum*
Eupatorium calaminthifolium
Eupatorium collinum
Eupatorium tepicanum
Eysenhardtia polystachya

Garrya ovata
Guardiola mexicana
Heterocentron mexicanum
Hymenostephium microcephalum
Lasiacis sorghoidea
Piptothrix jaliscensis
Porophyllum viridiflorum
Rhus allophylloides
Salvia chapalensis
Salvia iodantha
Salvia polystachia
Salvia purpurea
Salvia thyrsiflora
Stevia glandulosa
Stevia subpubescens
Verbesina greenmanii
Vernonia mucronata
Vernonia aff. *pallens*
Viguiera angustifolia
Viguiera pringlei
Ximenia parviflora

En altitudes superiores a 2000 m se vuelven importantes otros elementos, algunos de los cuales son comunes también en el bosque de oyamel:

Archibaccharis hirtella
Archibaccharis serratifolia
Baccharis heterophylla
Berberis spp.
Brickellia spp.
Ceanothus caeruleus
Cestrum sp.
Coriaria thymifolia
Cornus disciflora
Crataegus mexicana
Dahlia pinnata
Eupatorium mairetianum
Fuchsia michoacanensis
Fuchsia microphylla
Fuchsia pringlei
Fuchsia thymifolia
Holodiscus argenteus
Litsea glaucescens
Lobelia laxiflora
Monnina xalapensis
Pernettya aff. *ciliata*
Podachaenium eminens
Ribes ciliatum
Rumfordia floribunda
Salvia elegans
Salvia gesneriflora
Satureia macrostema
Senecio albonervius
Senecio angulifolius
Solanum nudum
Sphacele pinetorum
Stevia lucida
Symphoricarpos microphyllus
Ternstroemia pringlei
Vaccinium stenophyllum
Verbesina klattii
Verbesina liebmannii
Viburnum dispar

El número de componentes herbáceos suele ser muy elevado, aunque, como en el caso de los arbustos, en una localidad determinada no debe esperarse sino la presencia de una fracción de algunas de las especies más comunes que a continuación se citan. Es preciso observar que muchas de ellas abundan más bien en los claros de los bosques que a la sombra de los árboles.

Los siguientes pueden ser frecuentes en los bosques más altos y húmedos:

Acaena elongata
Adiantum spp.
Alchemilla aphanoides
Alchemilla procumbens
Alchemilla sibbaldiifolia
Arenaria lanuginosa
Asplenium monanthes
Brachypodium mexicanum
Bromus spp.
Cacalia eriocarpa
Cosmos carvifolius
Cosmos crithmifolius
Coulterophytum laxum
Cynoglossum pringlei
Drymaria spp.
Eryngium deppeanum
Eryngium globosum
Eryngium gracile
Geranium deltoideum
Geranium seemannii
Habenaria clypeata
Habenaria entomantha
Heliopsis procumbens
Hieracium abscissum
Hieracium fendleri
Jaegeria hirta
Jaegeria macrocephala
Lasiarrhenum strigosum

Lobelia jaliscensis
Lotus repens
Macromeria exserta
Macromeria longiflora
Malaxis spp.
Melampodium montanum
Micropleura renifolia
Oxalis spp.
Penstemon campanulatus
Penstemon kunthii
Pinguicula moranensis
Polymnia maculata
Pteridium aquilinum
Salvia mexicana
Senecio callosus
Sibthorpia pichinchensis
Sisyrinchium spp.
Stachys coccinea
Stellaria cuspidata
Trisetum virletii
Zeugites mexicana
Zeugites smilacifolia

Otros componentes herbáceos son:

Acalypha vagans
Adiantum patens
Aegopogon tenellus
Agalinis peduncularis
Ageratella palmeri
Ageratum salicifolium
Andropogon myosurus
Astragalus ervoides
Astragalus guatemalensis var. *brevidentatus*
Astranthium condimentum
Astranthium xylopodum
Baccharis potosina
Begonia gracilis
Begonia monoptera
Begonia ornithocarpa
Bessera elegans
Bidens spp.
Bletia gracilis
Bommeria spp.
Bouteloua hirsuta
Bouvardia longiflora
Bouvardia tenuifolia
Brickellia lanata
Buchnera obliqua
Bulbostylis juncoides
Cacalia palmeri
Cacalia sessilifolia
Cacalia sinuata
Calea palmeri
Calea peduncularis
Calochortus barbatus
Carex polystachya
Carex turbinata
Carphochaete grahami
Castilleja tenuiflora
Castilleja tenuifolia
Cheilanthes angustifolia
Cheilanthes farinosa
Cheilanthes lendigera
Cheilanthes pyramidalis
Commelina coelestis
Commelina dianthifolia
Cosmos exiguus
Crotalaria filifolia
Crusea spp.
Cuphea jorullensis
Cuphea llavea
Cyperus apiculatus
Cyperus flavus
Cyperus hermaphroditus
Cyperus manimae
Cyperus mutisii
Cyperus orbicephalus
Cyperus seslerioides
Cyperus spectabilis
Dahlia coccinea
Dalea pectinata
Desmodium cordistipulum
Desmodium occidentale
Donnellsmithia peucedanoides
Dryopteris patula
Erigeron karvinskianus
Eriosema diffusum
Eryngium beecheyanum
Eupatorium brevipes
Euphorbia biformis
Euphorbia spp.
Galium spp.
Gnaphalium spp.
Helianthemum glomeratum
Hilaria ciliata
Hygrophila pringlei
Hypericum spp.
Hypoxis decumbens
Iostephane heterophylla
Lamourouxia multifida
Lamourouxia viscosa
Loeselia amplectens
Loeselia mexicana
Muhlenbergia dumosa
Muhlenbergia leptoura

Muhlenbergia macroura
Muhlenbergia rigida
Neogoezia aff. *planipetala*
Oplismenus hirtellus
Oxalis spp.
Oxypappus seemannii
Panicum albomaculatum
Panicum bulbosum
Paspalum spp.
Peperomia umbilicata
Perezia wislizenii
Perymenium buphthalmoides
Piptochaetium fimbriatum
Pitcairnia karwinskyana
Polygala gracillima
Porophyllum nutans
Prochnyanthes viridescens
Ranunculus macranthus
Ranunculus petiolaris
Ruellia bourgaei
Ruellia sp.
Salvia guadalajarensis
Salvia hyptoides
Salvia lavanduloides
Salvia xalapensis
Senecio guadalajarensis
Seymeria virgata
Sisyrinchium spp.
Solanum spp.
Spigelia scabrella
Spiranthes aurantiaca
Stevia alatipes
Stevia elongata
Stevia viscida
Tagetes lucida
Tagetes subulata
Tephrosia saxicola
Thalictrum pringlei
Trachypogon montufari
Tradescantia crassifolia
Tripogandra amplexicaulis
Tristachya avenacea
Valeriana densiflora
Valeriana urticifolia
Verbena carolina
Viguiera spp.
Woodsia mollis
Zexmenia palmeri
Zinnia angustifolia
Zinnia greggii

Las epifitas vasculares suelen ser abundantes en las situaciones más húmedas, bien por el macroclima o bien por el microclima. Prevalecen entre ellas las orquidáceas y las bromeliáceas; se anotaron las siguientes:

Anthurium scandens
Catopsis compacta
Catopsis pendula
Cattleya aurantiaca
Epidendrum concolor
Epidendrum nemorale
Laelia autumnalis
Laelia furfuracea
Odontoglossum sp.
Oncidium sp.
Peperomia galioides
Philodendron sp.
Pleurothallis sp.
Polypodium angustifolium
Polypodium angustum
Polypodium furfuraceum
Polypodium madrense
Tillandsia bourgaei
Tillandsia macdougallii
Tillandsia plumosa
Tillandsia prodigiosa
Tillandsia aff. *rettigiana*
Tillandsia usneoides
Tillandsia aff. *violacea*

Las lianas gruesas no son características de los pinares y encinares, pero trepadoras herbáceas o leñosas delgadas existen y a veces pueden ser conspicuas, por ejemplo:

Bomarea sp.
Canavalia villosa
Clematis sp.
Cyclanthera sp.
Dioscorea spp.
Ipomoea spp.
Lonicera pilosa
Minkelersia galactoides
Parthenocissus quinquefolia
Phaseolus strobilophorus
Rhus radicans
Rubus spp.
Sicyos sp.
Smilax domingensis
Smilax moranensis
Solanum appendiculatum
Vitis bourgaeana

El bosque de *Pinus hartwegii* (Fig. 25), que vegeta usualmente a altitudes superiores a 3000 m, suele ser de tipo abierto y permite abundante desarrollo de gramíneas amacolladas, como *Festuca tolucensis*, *Muhlenbergia quadridentata*, *Calamagrostis tolucensis*. Otras plantas frecuentes en esta asociación son:

Alchemilla vulcanica
Bidens triplinervia var. *macrantha*
Castilleja cryptandra
Eryngium globosum
Eupatorium pazcuarense
Euphorbia campestris
Festuca sp.
Geranium vulcanicola
Lupinus montanus
Lupinus squamecaulis
Luzula racemosa
Penstemon campanulatus
Ribes ciliatum
Senecio callosus
Senecio toluccanus
Stevia elongata
Stevia lucida

En la parte más alta del Nevado de Colima, aproximadamente a 3900 m de altitud, se alcanza el límite de la vegetación arbórea. Por encima de esa cota, sobre substrato de arenas gruesas y poco compactas, frecuentemente predominan las tres gramíneas amacolladas más importantes del bosque de *Pinus hartwegii*, formando un zacatonal espaciado, en el que conviven también *Arenaria oresbia*, *A. bryoides* y *Draba jorullensis*. Algunas laderas pendientes y de arenas muy flojas carecen por completo de vegetación o solamente están colonizadas por escasas matas de *Arenaria*. En lugares rocosos de este piso alpino se observaron además: *Alchemilla vulcanica*, *Gnaphalium vulcanicum*, *Juniperus monticola* f. *compacta*, *Luzula racemosa*, *Pernettya ciliata*, *Potentilla richardii*, *Senecio toluccanus*, *Trisetum spicatum* y *Vaccinium geminiflorum*.

Fig. 25. Pinar de *Pinus hartwegii*, hacia la cumbre del Nevado de Colima, Jal. (Fot. McVaugh).

Fig. 26. El límite de la vegetación arbórea en el Volcán de Colima, vista de la cumbre del Nevado. Al frente pueden observarse unas gramíneas amacolladas y los vestigios de un pinar antiguo, parcialmente cubiertos por cenizas volcánicas. (Fot. Mc Vaugh).

Una composición florística especial se presenta en los encinares (generalmente de *Q. macrophylla* o de *Q. aristata*), que viven a altitudes inferiores de 1000 m. Aunque en alguas localidades se ha observado una vegetación heterogénea con aspecto de mezcla entre el encinar y el bosque tropical subdeciduo o entre el primero y las comunidades de tipo sabadoide, lo común es que el bosque de encino conserve bien su individualidad y no admita en su composición muchos elementos leñosos propios de otras asociaciones. En el sotobosque de la comunidad de *Q. macrophylla*, cerca de La Huerta, Jal., a 400 m sobre el nivel del mar se han encontrado representantes de los siguientes géneros:

Achimenes
Aeschynomene
Amoreuxia
Cacalia
Caesalpinia
Calliandra
Cuphea
Desmodium
Diphysa
Dorstenia
Erythrina
Hilaria
Lasiacis
Mimosa
Paspalum
Ruellia
Stevia
Triumfetta

Las comunidades secundarias que se desarrollan como consecuencia de la destrucción del bosque de encino y pino a menudo son de tipo herbáceo, dominadas por gramíneas. Muchos de estos zacatales dan la impresión de ser estables, pero sin duda el pastoreo y los incendios favorecen su existencia, sobre todo en condiciones climáticas de mayor humedad. Estos zacatales secundarios suelen ser muy ricos en especies herbáceas y muchas de las que se enumeraron como propias de los bosques de pino y encino, y que abundan en los claros del bosque, encuentran un habitat favorable en estos zacatales.

Comunidades de tipo arbustivo derivadas de encinares y pinares de altitudes inferiores a 2000 m suelen ser dominadas por *Acacia farnesiana* y *A. pennatula*, u otras veces por *Dodonaea viscosa*. *Hyptis albida*, *Verbesina*

sphaerocephala, *V. greenmanii* y *Zexmenia greggii* también pueden ser frecuentes. No debe excluirse la posibilidad de que algunas áreas señaladas en el mapa como cubiertas por el matorral subtropical en realidad correspondan a bosques de pino o encino destruidos.

Por encima de 2000 m los arbustos que más se establecen en los desmontes, especialmente hacia las zonas húmedas son: *Senecio salignus* y *Baccharis heterophylla*. Otros acompañantes suelen ser: *Mimosa aculeaticarpa*, *Crataegus pubescens*, *Senecio stoechadiformis*.

Bosques bajos de *Alnus* spp. en algunos lugares constituyen un estado secesional intermedio entre los matorrales y la comunidad clímax, pero quizás no todas las comunidades de *Alnus* deben interpretarse de esta manera, pues sobre las laderas del Nevado de Colima, a altitudes entre 3100 y 3300 m se localiza un bosque abierto de *Alnus firmifolia*, con el suelo cubierto por gramíneas amacolladas altas, principalmente *Calamagrostis erectifolia* y *Festuca amplissima*.

BOSQUE MESOFILO DE MONTAÑA

Con este nombre describió Miranda (1947: 99) de la cuenca del Balsas una comunidad vegetal que "se desarrolla en el mismo piso altitudinal del encinar, pero ocupa sobre todo las barrancas, donde las condiciones de humedad en el suelo y en el aire son más favorables."

En Nueva Galicia se ha observado un tipo de bosque que tanto por su situación ecológica, como por su composición florística resulta análogo al descrito por Miranda. Por consiguiente el nombre de bosque mesófilo de montaña puede aplicarse sin muchas reservas a la comunidad que se describe más adelante.

Su distribución geográfica es discontinua, pues se presenta en forma de manchones limitados dentro de las áreas generales del bosque de pino y encino de tipo más húmedo. Su presencia no es del todo rara a lo largo de la vertiente pacífica de México, ya que del norte de Sinaloa (Gentry, 1946a: 460) se describe una comunidad al menos florísticamente similar y las áreas señaladas por Leopold (1950: mapa) de la mitad meridional de Oaxaca como cubiertas por "cloud forest" sostienen el mismo tipo de bosque.

Es pertinente enfatizar las semejanzas fisonómicas, ecológicas y florísticas entre el "bosque mesófilo de montaña," propio de los declives pacíficos de México al oeste del Istmo de Tehuantepec, con el "bosque deciduo" o "bosque deciduo templado" (Miranda y Sharp, 1950; Miranda 1952:137; Rzedowski 1965: 196), característico de las vertientes atlánticas de México, de las sierras de Chiapas y de Guatemala. La temporada seca más prolongada y acentuada constituye un rasgo climático del primero que representa con toda probabilidad un factor limitante para la existencia de plantas características de los segundos, como *Liquidambar styraciflua*, *Fagus mexicana*, *Nyssa sylvatica*, etc., pero desconocidas del occidente. Algunos otros elementos, sin embargo, por ejemplo *Carpinus caroliniana*, *Ostrya virginiana*, *Tilia mexicana*, *Ternstroemia pringlei*, *Oreopanax xalapensis*, *Bocconia arborea*, *Cornus disciflora*, *Myrica mexicana*, son comunes a ambas formaciones y diversos géneros están representados por especies vicariantes.

Volviendo a hacer uso del mismo término, los dos tipos de vegetación podrían interpretarse en realidad como vicariantes y derivados quizás de un antecesor común más ampliamente distribuido en otras épocas.

El bosque mesófilo de montaña suele ser una comunidad densa, dominada por árboles de 20 a 40 m de alto (Fig. 27), habitando las laderas, a menudo muy inclinadas de barrancas, cañones y otros sitios protegidos, a altitudes entre 800 y 2400 m, en la mitad suroccidental de Jalisco y en zonas adyacentes de Nayarit, Colima y Michoacán. La composición florística en diferentes sitios y regiones no es necesariamente igual, y en una localidad determinada pueden encontrarse sólo algunos de los siguientes árboles altos:

Abies aff. *religiosa*
Alchornea latifolia
Carpinus caroliniana
Celtis monoica
Clethra spp.
Clusia aff. *salvinii*
Dendropanax arboreus
Dipholis minutiflora
Fraxinus uhdei
Gymnanthes actinostemoides
Ilex brandegeana
Juglans major var. *glabrata*
Juglans olanchana var. *standleyi*
Magnolia schiedeana
Matudaea trinervia
Meliosma dentata
Osmanthus americanus

Ostrya virginiana
Perrottetia longistylis
Persea sp.
Phoebe aff. *ehrenbergii*
Pinus pseudostrobus
Podocarpus aff. *reichei*
Prunus cortapico
Prunus rhamnoides
Quercus acutifolia
Quercus elliptica
Quercus aff. *insignis*
Quercus laxa
Quercus planipocula
Quercus salicifolia
Quercus scytophylla
Salix bonplandiana
Tilia mexicana
Trophis mexicana
Zinowiewia concinna

Entre los arbustos altos y árboles bajos destacan:

Ardisia compressa
Ardisia venosa
Arthrostylidium sp.
Bocconia arborea
Calliandra laevis
Calyptranthes pallens var. *mexicana*
Cestrum spp.
Chamaedorea sp.
Cleyera integrifolia
Conostegia sp.
Cordia prunifolia
Cornus disciflora
Cornus excelsa
Daphnopsis mexiae
Desmanthodium fruticosum
Eugenia crenularis
Eugenia culminicola
Eupatorium areolare
Eupatorium collinum
Eupatorium tepicanum
Fuchsia arborescens
Fuchsia michoacanensis
Hedyosmum mexicanum
Hymenostephium microcephalum
Inga eriocarpa
Inga laurina
Kohleria elegans
Lippia umbellata
Miconia sp.
Monnina aff. *xalapensis*
Myrica mexicana
Oreopanax echinops
Oreopanax peltatus
Oreopanax xalapensis
Parathesis spp.
Photinia oblongifolia
Phyllonoma laticuspis
Piper uhdei
Rapanea ferruginea
Rhus allophylloides
Rondeletia aff. *buddleioides*
Rumfordia floribunda
Saurauia serrata
Sebastiania jaliscensis
Siparuna nicaraguensis
Solanum brachystachys
Stevia subpubescens
Styrax argenteus
Styrax ramirezii
Symplococarpon hintonii
Symplocos prionophylla
Ternstroemia pringlei
Triumfetta sp.
Turpinia occidentalis

El desarrollo de epifitas y de trepadoras puede ser notable, no así de plantas herbáceas, siendo pocas las que encuentran condiciones adecuadas a la profunda sombra de los árboles y arbustos. De las epifitas pueden mencionarse:

Anthurium fortinense
Elaphoglossum spp.
Epiphyllum aff. *anguliger*
Erythrodes querceticola
Fuchsia decidua
Fuchsia fulgens
Heliocereus speciosus
Oncidium sp.
Polypodium spp.
Tillandsia schiedeana
Tillandsia sp.

Fig. 27. Bosque mesófilo de montaña, cerca de Jalcocotán, Nay., con *Quercus* spp., *Carpinus caroliniana*, *Ilex brandegeana*, *Ostrya virginiana*. (Fot. McVaugh).

Las trepadoras incluyen las siguientes:

Canavalia sp.
Celastrus pringlei
Clematis sp.
Lonicera pilosa
Parthenocissus quinquefolia
Philadelphus mexicanus
Philodendron tripartitum
Rhus radicans
Smilax moranensis
Smilax pringlei
Solandra nitida
Syngonium sp.
Vitis bourgaeana
Vitis tiliifolia

Entre los elementos herbáceos más característicos del sotobosque se encuentran helechos de los géneros *Adiantum*, *Asplenium*, *Botrychium*, *Cystopteris* y *Dryopteris*, así como la Arácea *Arisaema macrospathum*.

BOSQUE DE OYAMEL

Los bosques de *Abies* ocupan un lugar especial dentro del cuadro general de la vegetación de México, gracias a su aspecto, a su ecología y a su composición florística definida. La mayoría de estos bosques se encuentra localizada entre 2500 y 3500 m sobre el nivel del mar, en el piso altitudinal inmediatamente inferior al subalpino, y debido a esta analogía ecológica y florística con la taiga Leopold (1950: 509) no vaciló en denominarlos "boreal forest."

La realidad es, sin embargo, que no todos los bosques de oyamel de México dejan encuadrarse en esta interpretación, pues en ciertas áreas de la vertiente pacífica y en Chiapas se les encuentra a altitudes de 1700 m e inclusive a 1500 m sobre el nivel del mar. Miranda (1952: 161) supone que estas aparentes anomalías pueden deberse a que el clima de los lugares en que el bosque de *Abies* desciende fuera de sus límites usuales debe ser de conformidad más frío. Otra explicación posible de este fenómeno sería la existencia de especies, variedades o ecotipos de *Abies* adaptados a condiciones de temperatura más elevada, capaces de colonizar y competir con otras plantas en tales ambientes, o al menos de mantenerse en su posición, si acaso pudiera tratarse de reliquias de épocas en que el clima era diferente.

En Nueva Galicia parecen existir tres áreas principales en las cuales el bosque de oyamel ocupa superficies de cierta importancia. Una de ellas se localiza en el estado de Michoacán, en las laderas del Cerro Tancítaro; otra ocupa los declives del macizo del Nevado de Colima; la tercera tiene la forma de un cinturón angosto y alargado que se extiende desde los alrededores de San Sebastián, en las partes altas de la cuenca del río Ameca, hasta las montañas al sureste de Autlán. La última área representa en su mayor parte una faja de pinares y encinares húmedos con machones a veces muy espaciados de bosque de oyamel.

Pequeñas áreas aisladas se localizan además en diversas localidades de Jalisco, Michoacán y probablemente de Nayarit.

El bosque de *Abies* es una comunidad mesófila por excelencia y, dado el régimen climático general de la zona bajo estudio, se restringe en Nueva Galicia a laderas protegidas de barrancas y habitats similares. A menudo substituye el bosque mesófilo de montaña en las partes más altas de los cañones y los dos tipos de vegetación presentan a veces una transición gradual con mezcla de elementos de ambas procedencias.

Cuando puro, tiene el aspecto de un bosque denso, de 20 a 40 m de alto, poco tolerante a la compañía de arbustos y plantas herbáceas. En la mayor parte de los casos, sin embargo, bien por razones de topografía quebrada, o de intervención humana, o bien por otras causas, el bosque, aunque dominado por *Abies*, no es tan denso y con frecuencia incluye diversos elementos arbóreos, arbustivos y herbáceos.

La especie más frecuente de *Abies*, especialmente a altitudes superiores de 2500 m, es *A. religiosa*. En los bosques de oyameles que se desarrollan a menor elevación las plantas suelen ser un poco diferentes y se han identificado como *A. religiosa* var. *emarginata* y otras veces como *A. guatemalensis* var. *jaliscana*. Las diferencias entre los últimos dos taxa parecen ser de poca cuantía y, de no tratarse de una convergencia, deben ser muy cercanos.

Entre las plantas arbóreas presentes con mayor frecuencia en los bosques de *Abies* pueden citarse:

Almus firmifolia
Arbutus xalapensis
Cupressus lindleyi
Meliosma dentata
Ostrya virginiana
Pinus hartwegii
Pinus pseudostrobus
Podocarpus aff. *reichei*
Quercus candicans
Quercus castanea
Quercus crassifolia
Quercus laurina
Viburnum dispar

De los arbustos merecen mención:

Archibaccharis hieracioides
Archibaccharis hirtella
Arctostaphylos arguta
Arctostaphylos longifolia
Baccharis heterophylla
Berberis sp.
Brickellia sp.
Buddleia parviflora
Ceanothus caeruleus
Celastrus pringlei
Cornus disciflora
Dahlia pinnata
Eugenia culminicola
Eupatorium areolare
Eupatorium mairetianum
Fuchsia michoacanensis
Fuchsia microphylla
Fuchsia thymifolia
Garrya laurifolia
Holodiscus argenteus
Hymenostephium microcephalum
Monnina aff. *xalapensis*
Monochaetum sp.
Pernettya aff. *ciliata*
Phenax hirtus
Rapanea sp.
Rhus allophylloides
Ribes ciliatum
Rumfordia floribunda
Salix oxylepis
Salvia chapalensis
Salvia cinnabarina
Salvia elegans
Salvia gesneriflora
Salvia iodantha
Salvia longistyla
Salvia mexicana
Salvia purpurea
Sarcococca conzattii
Satureia macrostema
Senecio albonervius
Senecio angulifolius
Senecio barba-johannis
Solanum cervantesii
Solanum lentum
Stevia lucida
Styrax ramirezii
Symphoricarpos microphyllus
Symplocos prionophylla
Ternstroemia pringlei
Verbesina klattii
Zanthoxylum sp.

VEGETACION SEMIACUATICA Y ACUATICA

La descripción de la vegetación de Nueva Galicia quedaría incompleta si se dejaran de mencionar las comunidades vegetales ligadas al suelo permanente o temporalmente inundado, o con nivel freático próximo a la superficie.

Por su topografía y por su estructura geológica la región bajo estudio incluye un sinnúmero de localidades con este tipo de habitat. Son de particular importancia muchos llanos mal drenados, en su mayoría vestigios de antiguos lagos y lagunas, que están siempre húmedos o bien se encharcan en forma periódica. Estas áreas semipantanosas en Nueva Galicia alcanzan una superficie total de muchos cientos de kilómetros cuadrados y constituyen un elemento importante en el paisaje, sobre todo en la parte central de Jalisco.

Una asociación vegetal semiacuática arbórea o arbustiva, ligada a las lagunas costeras, se describe en un inciso aparte bajo el nombre de manglar. Otras comunidades dominadas por árboles y arbustos son las que a menudo se desarrollan a la orilla de ríos. Las áreas periódica o temporalmente inundadas por agua dulce, en cambio, se caracterizan por una vegetación que, en su gran mayoría, es de tipo herbáceo.

Donde las condiciones permiten el desarrollo de vegetación flotante, pueden encontrarse entre otras las siguientes especies:

Azolla spp.
Callitriche heterophylla
Ceratophyllum demersum
Eichhornia azurea
Eichhornia crassipes
Lemna gibba
Lemna perpusilla
Lemna valdiviana
Marsilea fournieri
Marsilea mexicana
Najas guadalupensis
Neptunia prostrata
Nymphaea ampla
Nymphoides humboldtiana
Pistia stratiotes
Potamogeton diversifolius
Potamogeton nodosus
Potamogeton pusillus
Ruppia maritima
Spirodela polyrhiza
Zannichellia palustris

Pistia parece ser más frecuente en los lugares cercanos a la costa; *Eichhornia crassipes*, en cambio, abunda a tal grado en algunos lagos de las regiones más elevadas, que llega a cubrir enormes superficies impidiendo la navegación y la pesca.

Unas cuantas especies de la familia de las Podostemonáceas, incluyendo *Oserya coulteriana*, *Marathrum elegans*, y *Tristicha hypnoides*, pueden abundar pegadas a las piedras de algunos arroyos o ríos permanentes de corriente rápida y escasa profundidad.

Los lugares de aguas someras se ven generalmente habitados por plantas anfibias arraigadas, algunas de talla modesta, otras de 1 ó 2 m de alto. Las observadas con mayor constancia fueron:

Agrostis semiverticillata
Ammania auriculata
Aster exilis
Bacopa auriculata
Bacopa monnieri
Bacopa repens
Bidens aurea
Canna sp.
Cuphea procumbens
Cyperus albomarginatus
Cyperus esculentus
Cyperus giganteus
Cyperus laevigatus
Cyperus odoratus

Cyperus semiochraceus
Cyperus subnodosus
Dichromena sp.
Echinochloa colonum
Echinochloa crus-galli vars.
Echinochloa holciformis
Echinodorus andrieuxii
Eleocharis caribaea
Eleocharis densa
Eleocharis dombeyana
Eleocharis macrostachya
Eleocharis montevidensis
Eleocharis quadrangulata
Eragrostis bahiensis
Eriocaulon benthamii
Eriocaulon ehrenbergianum
Escobedia laevis
Euphorbia paludicola
Euphrosyne partheniifolia
Heteranthera limosa
Heteranthera peduncularis
Heteranthera reniformis
Hydrochloa caroliniensis
Hydrocotyle umbellata
Hydrocotyle verticillata var. *triradiata*
Hymenachne amplexicaulis
Isoetes mexicana
Juncus balticus var. *mexicanus*
Juncus effusus
Juncus microcephalus
Jussiaea bonariensis
Jussiaea repens var. *peploides*
Leersia hexandra
Lilaea scilloides
Lindernia anagallidea
Lobelia cardinalis
Luziola gracillima
Lythrum gracile
Olivaea tricuspis
Panicum hians
Paspalum distichum
Paspalum lividum
Paspalum longicuspe
Paspalum plicatulum
Paspalum pubiflorum
Paspalum virgatum
Polygonum portoricense
Polygonum punctatum
Rotala dentifera
Sacciolepis myuros
Sagittaria latifolia
Sagittaria sp.
Scirpus olneyi
Scirpus validus
Stemodia bartsioides
Thalia geniculata
Typha sp.
Verbena litoralis
Xyris jupicai
Xyris mexicana

En lugares cercanos a la costa, en donde puede haber mayor influencia de agua salina, se han observado también:

Acrostichum danaeifolium
Batis maritima
Fimbristylis dichotoma
Fimbristylis miliacea
Sporobolus splendens

De las pocas plantas leñosas que prosperan en lugares mal drenados y periodicamente encharcados destaca *Mimosa pigra,* misma que junto con *Astianthus viminalis, Salix chilensis, Pluchea odorata* y *Ficus* spp. constituye la vegetación característica de las orillas de los ríos en la zona baja.

Hacia las regiones más elevadas bosquecillos de *Salix bonplandiana* y *S. chilensis,* así como matorrales de *Baccharis glutinosa* y de *Salix taxifolia* ocupan el nicho ecológico correspondiente. *Taxodium mucronatum* sólo se ha observado en abundancia a lo largo de algunos afluentes del río Lerma y en forma esporádica en otros sitios. Es notable la aparente ausencia completa de *Platanus* en Nueva Galicia, puesto que árboles de este género son muy característicos en los bosques ribereños de muchas partes de México.

MANGLAR

Este nombre se aplica a un tipo de vegetación característico de las orillas de esteros, desembocaduras de ríos y algunos otros habitats similares, que se localizan cerca del litoral y que se distinguen por un suelo de origen aluvial somera pero periodicamente inundado por aguas salobres o salinas, tranquilas, sin resultar afectado por un oleaje fuerte.

Se le encuentra a lo largo de la costa de Nueva Galicia con mayor o menor frecuencia ocupando franjas discontinuas que rara vez exceden 2 km de ancho y se internan poco tierra adentro.

El manglar es una comunidad sobresaliente por su fisonomía y composición florística. En ocasiones alcanza la forma y la altura de un bosque, pero más frecuentemente se presenta como una cubierta continua de 3 a 5 m de alto, apoyada sobre una maraña de raices aéreas leñosas (Fig. 28). Las hojas de sus componentes son persistentes, gruesas y algo suculentas.

La comunidad carece por completo de elementos herbáceos y el número de los arborescentes o arbustivos es muy limitado. La mayor parte del área cubierta por el manglar en la zona estudiada corresponde a un tapiz monotípico de *Rhizophora mangle*, a exclusión completa de otras plantas vasculares. Esta facies es la que penetra más hacia el interior de las lagunas salobres; cerca de la orilla suelen unírsele *Laguncularia racemosa*, *Conocarpus erecta* y *Avicennia nitida*. La última especie puede ser dominante y exclusiva en algunas situaciones de muy escasa sumersión.

Fig. 28. Manglar de *Rhizophora mangle*, cerca de Barra de Navidad, Jal. (Fot. Rzedowski).

Otras plantas que se han encontrado conviviendo a veces en el manglar, pero más bien hacia su periferie, son:

Acacia cymbispina
Achatocarpus gracilis
Bravaisia integerrima
Cissus rhombifolia
Coccoloba barbadensis
Entada polystachia
Hibiscus tiliaceus
Hippomane mancinella
Mimosa pigra
Phyllanthus elsiae
Pithecellobium lanceolatum
Pluchea odorata
Prosopis juliflora
Rauwolfia hirsuta
Salix chilensis
Struthanthus venetus

THE VEGETATION OF NUEVA GALICIA

This study comprises a preliminary description of the plant-communities of the Mexican States of Aguascalientes, Colima and Jalisco, and parts of Nayarit, Durango, Zacatecas, Guanajuato and Michoacán. The boundaries of the area coincide in a general way with those of the old Viceroyalty of Nueva Galicia (cf. McVaugh, 1961: 145 - 146; fig. 1). It is an area of about 125,000 km^2, the western edge of which is formed by the Pacific Ocean. We recognize, in accordance with the classification of Gutiérrez Vázquez (1959), the following physiographic provinces in Nueva Galicia (see fig. 2, p. 3):

1. Region of canyons. (Región de los Canoñes). The area occupied by the Río Santiago and its affluents from the north and east, comprising a series of precipitous canyons alternating with ridges 700 to 1500 m above the rivers.

2. The highland (Región de los Altos). The western edge of the Mexican plateau, here sloping off from northeast to southwest, at elevations ranging from about 2200 m to about 1600 m.

3. The interior basins (Región de las Cuencas Centrales). A series of shallow lake-basins at elevations of from 1250 to 1600 m, mostly south and west of Lake Chapala. Some of the shallowest lakes are without exterior drainage.

4. Mountains of the Pacific slope (Región montañosa y declives del Pacífico). A heterogeneous region, mostly mountainous, representing in a general way the area of confluence of the principal mountain chains of western Mexico (Sierra Madre Occidental, Eje Volcánico Transversal, Sierra Madre del Sur). Elevations range from sea level to 4330 m.

Volcanic rocks, often alternating with recent alluvial deposits, predominate in Nueva Galicia. More than half the territory is drained by the Lerma - Santiago river system. The climate is characterized by the absence of a cold winter season, and by the alternation of pronounced wet (May - October) and dry (November - April) seasons. Average annual rainfall varies from about 500 to more than 1500 mm. Depending upon elevation, exposure and other features of the site, the vegetation-types corresponding to varying amounts of precipitation range from grassland and arid shrubland to mesophytic forest.

We distinguish 13 characteristic vegetation-types within the area of this study. Of these the largest in areal extent are the Tropical subdeciduous forest (*Bosque tropical subdeciduo*), Tropical deciduous forest (*Bosque tropical deciduo*), Thorn forest (*Bosque espinoso*), Subtropical scrub (*Matorral subtropical*), Grassland (*Zacatal*), and Pine-oak forest (*Bosque de pino y encino*). These and the other types of lesser extent are characterized in the tabular summary that follows.

The approximately 1400 species of vascular plants listed in the body of this paper are those that in our opinion are most characteristic of, abundant in, or dominant in, the different zones. The vascular flora as a whole is thought to include more than 6000 species. The floristic relationships of Nueva Galicia are as yet imperfectly known; the flora includes a strong Mexican-Central American element, as well as a considerable number of endemic species and species characteristic of the Trans-Mexican volcanic range. We have obtained the names listed in this work from a variety of sources, but chiefly from study of our own collections made in Nueva Galicia between 1949 and 1966. Taxonomic study of these collections is in progress, and some of our identifications of species are necessarily tentative.

TABULAR SUMMARY OF THE VEGETATION-TYPES

Vegetation-type	Approximate extent in Nueva Galicia %	Altitudinal limits m	Average annual temperature °C	Absolute minimum temperature °C	Average annual precipitation mm
Palm forest	<1	0 - 50	25 - 27	>0	?600 - ?1000
Tropical subdeciduous forest	±10	0 - 1200	22 - 27	>0	750 - ?1600
Tropical deciduous forest	15 - 20	0 - 1600	20 - 28	±0	600 - 1000
Thorn forest	2 - 3	0 - 2000	17 - 29	<0	500 - 750
Subtropical scrub	15 - 20	1500 - 2000	17 - 21	<0	500 - 900
Savannah-like vegetation	±1	50 - 800	23 - 27?	>0	?700 - ?1200
Grassland	15 - 20	1700 - 4300	3 - 18	<0	350 - ?800
Crassicaulescent scrub	±1	1800 - 2200	16 - 18	<0	350 - 550
Pine - oak forest	25 - 30	300 - 4000	5 - 25	<0	400 - ?1500
Mesophytic mountain forest	<1	800 - 2400	15 - 23?	<0	?1000 - ?2000
Fir forest	<1	1500 - 3500	7 - 21?	<0	?1000 - ?1500
Aquatic vegetation	±1	0 - 4000	5 - 29	<0	350 - ?2000
Mangrove	<1	0 - 5	25 - 27	>0	?600 - ?1000

TABULAR SUMMARY OF THE VEGETATION-TYPES (continued)

Soil preference	Characteristic plants
Sands, near the coast	Orbignya cohune, Ficus spp.
—	Brosimum alicastrum, Bumelia cartilaginea, Bursera arborea, Celtis monoica, Enterolobium cyclocarpum, Ficus spp., Hura polyandra
Shallow, hillsides	Amphipterygium spp., Bursera spp., Ceiba aesculifolia, Loncho-carpus spp., Lysiloma divaricata
Deep	Acacia spp., Caesalpinia spp., Cercidium praecox, Haematoxylon brasiletto, Pithecellobium dulce, Prosopis laevigata, Ziziphus spp.
Shallow, hillsides	Acacia pennatula, Eysenhardtia polystachya, Forestiera spp., Ipomoea spp., Opuntia fuliginosa
—	Byrsonima crassifolia, Crescentia alata, Curatella americana
—	Andropogon spp., Aristida spp., Bouteloua spp., Hilaria cench-roides, Muhlenbergia spp., Acacia tortuosa
—	Opuntia guilanchi, Opuntia streptacantha, Mimosa biuncifera, Mimosa monancistra
—	Pinus spp., Quercus spp., Arbutus spp.
Shallow, hillsides	Carpinus caroliniana, Clethra spp., Prunus spp., Quercus acuti-folia, Styrax spp., Symplocos prionophylla
Shallow, hillsides	Abies spp., Alnus firmifolia, Meliosma dentata, Quercus laurina
—	—
Saline, coastal lagoons	Rhizophora mangle, Avicennia nitida

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ENUMERACION SISTEMATICA DE LAS ESPECIES CITADAS EN EL TEXTO

Los nombres incluidos en la siguiente lista corresponden a los taxa mencionados en este trabajo como elementos importantes de la vegetación de Nueva Galicia. Las plantas citadas en el texto, que no se conocen como componentes de la flora silvestre de la región, están incluidas en el índice alfabético, pero no aparecen en la enumeración sistemática. Las que no han sido identificadas sino hasta género, se encuentran referidas bajo el nombre de éste, seguido por "sp." cuando se trata de una especie, ó por "spp." cuando son varias. Los binomios en paréntesis angulares, que siguen a los nombres aceptados en esta lista, son los que Standley utilizó para los mismos (ó aproximadamente los mismos) taxa en *Trees and shrubs of Mexico* (Contr. U.S. Nat. Herb. 23: 1-1721. 1920-26).

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GYMNOSPERMAE

CYCADACEAE

Zamia sp.

PODOCARPACEAE

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MONOCOTYLEDONES

TYPHACEAE

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BUXACEAE

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Amphipterygium spp.

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Comocladia spp.
Cyrtocarpa procera HBK. Nov. Gen. & Sp. 7: 20. 1825.
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Spondias purpurea L. Sp. Pl. ed. 2. 613. 1762 [*S. mombin* L.].

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Cupania glabra Sw. Prodr. Veg. Ind. Occ. 61. 1788.
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Thouinia acuminata S. Wats. Proc. Am. Acad. 25: 145. 1890.
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Colubrina triflora Brongn. ex G. Don, Gen. Hist. 2: 36. 1832 [*C. glomerata* (Benth.) Hemsl.].
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Ziziphus amole (Sessé & Moc.) M.C. Johnst. Am. Jour. Bot. 50: 1021. 1963. [*Zizyphus sonorensis* S. Wats.].
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Cissus rhombifolia Vahl, Eclog. 1: 11. 1796.
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Heliocarpus cf. *occidentalis* Rose, Contr. U.S. Nat. Herb. 5: 127. 1897.
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Triumfetta brevipes S. Wats. Proc. Am. Acad. 22: 400. 1887.
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Triumfetta spp.

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Hibiscus tiliaceus L. Sp. Pl. 694. 1753.
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Robinsonella sp.
Sida linifolia Juss. ex Cav. Monad. Diss. 1: 14. 1785.
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Helicteres guazumifolia HBK. Nov. Gen. & Sp. 5: 304. 1821.
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Saurauia serrata DC. Mém. Soc. Phys. Hist. Nat. Genève 1: 420. 1822 [incl. *S. reticulata* Rose].

DILLENIACEAE

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THEACEAE

Cleyera integrifolia (Benth.) Planch. ex Hemsl. Biol. Centr. Am. Bot. 1: 93. 1879 [*Eurya mexicana* (Turcz.) Syzsz.].
Symplococarpon hintonii (Bullock) Airy Shaw, in Hook. Ic. 34: *pl. 3342.* 1937.
Ternstroemia pringlei (Rose) Standl. Field Mus. Publ. Bot. 4: 234. 1929 [*Taonabo pringlei* Rose].

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Calophyllum brasiliense var. *rekoi* (Standl.) Standl. Trop. Woods 30: 7. 1932. [*C. rekoi* Standl.].
Clusia aff. *salvinii* Donn. Sm. Bot. Gaz. 35: 1. 1903.
Hypericum spp.

FOUQUIERIACEAE

Fouquieria formosa HBK. Nov. Gen. & Sp. 6: 83. 1823.

CISTACEAE

Helianthemum glomeratum (Lag.) DC. in DC. Prodr. 1: 269. 1824 [*Halimium glomeratum* (Lag.) Grosser].

BIXACEAE

Bixa orellana L. Sp. Pl. 512. 1753.

COCHLOSPERMACEAE

Amoreuxia palmatifida DC. in DC. Prodr. 2: 638. 1825.
Cochlospermum vitifolium (Willd.) Spreng. Syst. Veg. 2:596. 1825 [*Maximilianea vitifolia* (Willd.) Krug & Urb.].

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Hybanthus aff. *mexicanus* Ging. in DC. Prodr. 1: 312. 1824.
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Hybanthus spp.

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Casearia pringlei Briq. Ann. Cons. Jard. Bot. Genève 2: 67. 1898.
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Xylosma velutinum (Tul.) Tr. & Karst. in Karst. Fl. Columb. 1: 123. 1858. [*Myroxylon velutinum* (Tul.) Warb.].

TURNERACEAE

Turnera pumilea L. Syst. Nat. ed. 10. 965. 1759.
Turnera sp.

PASSIFLORACEAE

Passiflora spp.

CARICACEAE

Carica mexicana (A.DC.) L. Wms. Fieldiana Bot. 29:368. 1961. [*Leucopremna mexicana* (A.DC.) Standl.].

BEGONIACEAE

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Begonia monoptera Link & Otto, Ic. Pl. Rar. 27. *pl. 14.* 1828.
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Begonia spp.

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Echinofossulocactus sp.
Epiphyllum aff. *anguliger* (Lem.) Don ex Loud. Encyc. Pl. ed. 3. 1380. 1855.
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Nopalea sp.
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Opuntia guilanchi Griffiths, Rep. Missouri Bot. Gard. 19: 265. 1908.
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Opuntia robusta Wendl. ex Pfeiff. Enum. Cact. 165. 1837.
Opuntia streptacantha Lem. Cact. Hort. Monv. 62. 1839.
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LYTHRACEAE

Ammannia auriculata Willd. Hort. Berol. 1: 7. 1803.
Cuphea hookeriana Walp. Rep. Bot. 2: 107. 1843 [*Parsonsia hookeriana* (Walp.) Standl.].
Cuphea jorullensis HBK. Nov. Gen. & Sp. 6: 208. 1823 [*Parsonsia jorullensis* (HBK.) Standl.].
Cuphea llavea Lex. in Ll. & Lex. Nov. Veg. Descr. 1: 20. 1824. [*Parsonsia llavea* (Lex.) Standl.].
Cuphea lobophora Koehne in Mart. Fl. Bras. 13, pt. 2: 235. 1877 [*Parsonsia lobophora* (Koehne) Standl.].
Cuphea procumbens Cav. Ic. 4: 55. 1797.
Cuphea spp.
Lythrum gracile Benth. Pl. Hartw. 7. 1839.
Rotala dentifera (A. Gray) Koehne, Bot. Jahrb. 1: 161. 1880.

RHIZOPHORACEAE

Rhizophora mangle L. Sp. Pl. 443. 1753.

COMBRETACEAE

Combretum farinosum HBK. Nov. Gen. & Sp. 6: 110. 1823.
Combretum laxum Jacq. Enum. Pl. Carib. 19. 1760. [*C. mexicanum* Humb. & Bonpl.].
Conocarpus erecta L. Sp. Pl. 176. 1753.
Laguncularia racemosa (L.) Gaertn. f. Fruct. & Sem. 3: 209. 1807.

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Eugenia acapulcensis Steud. Nom. ed. 2. 1: 601. 1840.
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Eugenia salamensis Donn. Sm. Bot. Gaz. 27: 333. 1899 [*E. oaxacana* Standl., *E. tomentulosa* Standl.].
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Psidium sartorianum (Berg) Ndzu. in Engl. & Prantl, Nat. Pflanzenfam. 3, pt. 7: 69. 1893.

MELASTOMATACEAE

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Conostegia sp.
Heterocentron mexicanum Hook. & Arn. Bot. Beech. Voy. 290. 1838.
Miconia albicans (Sw.) Triana, Trans. Linn. Soc. Bot. 28: 116. 1871.
Miconia spp.
Monochaetum spp.
Pterolepis pumila (DC.) Cogn. in Mart. Fl. Bras. 14, pt. 3: 263. 1885.

ONAGRACEAE

Fuchsia arborescens Sims, Bot. Mag. *pl. 2620.* 1826.
Fuchsia decidua Standl. Field Mus. Publ. Bot. 4: 248. 1929.
Fuchsia fulgens DC. in DC. Prodr. 3: 39. 1828.
Fuchsia michoacanensis Sessé & Moc. Pl. Nov. Hisp. 58. 1888. [*F. chiapensis* Brandg.; *F. minutiflora* Hemsl. p.p.].
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Fuchsia pringlei Rob. & Seat. Proc. Am. Acad. 28: 106. 1893.
Fuchsia thymifolia HBK. Nov. Gen. & Sp. 6: 104. 1823.
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Jussiaea repens var. *peploides* (HBK.) Griseb. Cat. Pl. Cub. 107. 1866.
Semeiandra grandiflora Hook. & Arn. Bot. Beech. Voy. 291. 1838.

ARALIACEAE

Aralia sp.

Dendropanax arboreus (L.) Dec. & Planch. Rev. Hortic. IV. 3: 107. 1854. [*Gilibertia arborea* (L.) Marchal].
Oreopanax echinops (Schlecht. & Cham.) Dec. & Planch. Rev. Hortic. IV. 3: 108. 1854.
Oreopanax peltatus Linden ex Regel, Gartenflora 11: 170. 1862. [*O. salvinii* Hemsl.].
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Donnellsmithia peucedanoides (HBK.) Math. & Const. Bull. Torrey Club 68: 122. 1941.
Eryngium beecheyanum Hook. & Arn. Bot. Beech. Voy. 294. 1838.
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Hydrocotyle umbellata L. Sp. Pl. 234. 1753.
Hydrocotyle verticillata var. *triradiata* (A. Rich.) Fern. Rhodora 41: 437. 1939.
Micropleura renifolia Lag. Obs. Umbell. 15. 1826.
Neogoezia aff. *planipetala* (Hemsl.) Hemsl. Kew Bull. 1894: 355. 1894.

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Cornus excelsa HBK. Nov. Gen. & Sp. 3: 430. 1820.
Garrya laurifolia Benth. Pl. Hartw. 14. 1839.
Garrya ovata Benth. Pl. Hartw. 14. 1839.

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Clethra rosei Britton, N. Am. Flora 29: 6. 1914.
Clethra spp.

ERICACEAE

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Arbutus xalapensis HBK. Nov. Gen. & Sp. 3: 279. 1819.
Arctostaphylos angustifolia (Klotzsch) Hemsl. Biol. Centr. Am. Bot. 2: 278. 1881.
Arctostaphylos arguta (Zucc.) DC. in DC. Prodr. 7: 585. 1839.
Arctostaphylos longifolia Benth. Pl. Hartw. 44. 1840.
Arctostaphylos polifolia HBK. Nov. Gen. & Sp. 3: 277. 1819.
Arctostaphylos pungens HBK. Nov. Gen. & Sp. 3: 278. 1819.
Befaria mexicana Benth. Pl. Hartw. 15. 1839.
Pernettya ciliata (Schlecht. & Cham.) Small, N. Am. Flora 29: 82. 1914.
Vaccinium geminiflorum HBK. Nov. Gen. & Sp. 3: 267. 1819.
Vaccinium stenophyllum Steud. Nom. ed. 2. 2: 740. 1841.

THEOPHRASTACEAE

Jacquinia aurantiaca Ait. Hort. Kew. ed. 2. 2: 6. 1811.
Jacquinia pungens A. Gray, Mem. Am. Acad. II. 5: 325. 1855.

MYRSINACEAE

Ardisia compressa HBK. Nov. Gen. & Sp. 3: 245. 1819. [*Icacorea compressa* (HBK.) Standl.].
Ardisia revoluta HBK. Nov. Gen. & Sp. 3: 246. 1819 [*Icacorea revoluta* (HBK.) Standl.].
Ardisia venosa Mast. Bot. Gaz. 18: 205. 1893.
Parathesis spp.
Rapanea ferruginea (Ruiz & Pav.) Mez, in Urb. Symb. Antill. 2: 429. 1901.
Rapanea sp.

PLUMBAGINACEAE

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Dipholis minutiflora Pittier, Contr. U.S. Nat. Herb. 13: 464. 1912.

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STYRACACEAE

Styrax argenteus Presl, Rel. Haenk. 2: 60. 1836.
Styrax ramirezii Greenm. Proc. Am. Acad. 34: 20. 1899.

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Symplocos prionophylla Hemsl. Biol. Centr. Am. Bot. 2: 302. 1881.

OLEACEAE

Forestiera phillyreoides (Benth.) Torr. in Emory, U.S. & Mex. Bound. Surv. 2, pt. 1: 167. 1859.
Forestiera tomentosa S. Wats. Proc. Am. Acad. 25: 157. 1890.
Fraxinus uhdei (Wenzig) Lingelsh. Bot. Jahrb. 40: 221. 1907.
Osmanthus americanus (L.) A. Gray, Syn. Fl. N. Am. 2, pt. 1: 78. 1878.

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Buddleia parviflora HBK. Nov. Gen. & Sp. 2: 353. 1817.
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Cynoctonum mitreola (L.) Britton, Mem. Torrey Club 5: 258. 1894.
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Spigelia spp.
Strychnos brachistantha Standl. Field Mus. Publ. Bot. 12: 412. 1936.
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GENTIANACEAE

Centaurium spp.
Nymphoides humboldtianum (HBK.) Kuntze, Rev. Gen. 2: 429. 1891.
Schultesia aff. *guianensis* (Aubl.) Malme, Arkiv. Bot. 3, pt. 12: 9. 1904.

APOCYNACEAE

Haplophyton cimicidum A. DC. in DC. Prodr. 8: 412. 1844.
Macrosiphonia hypoleuca (Benth.) Muell. Arg. Linnaea 30: 452. 1860.
Mandevilla foliosa (Muell. Arg.) Hemsl. Biol. Centr. Am. Bot. 2: 316. 1881.
Mandevilla subsagittata (Ruiz & Pav.) Woods. Ann. Missouri Bot. Gard. 19: 69. 1932 [*Echites* spp.].
Plumeria rubra L. Sp. Pl. 209. 1753.
Rauwolfia hirsuta Jacq. Enum. Pl. Carib. 14. 1760 [*R. canescens* L.].
Stemmadenia tomentosa var. *palmeri* (Rose & Standl.) Woods. Ann. Missouri Bot. Gard. 15:354. 1928. [*S. palmeri* Rose & Standl.].
Tabernaemontana amygdalifolia Jacq. Enum. Pl. Carib. 14. 1760.
Thevetia ovata (Cav.) A. DC. in DC. Prodr. 8: 344. 1844.
Thevetia peruviana (Pers.) K. Schum. in Engl. & Prantl, Nat. Pflanzenfam. 4, pt. 2: 159. 1895.
Thevetia plumeriifolia Benth. Bot. Voy. Sulph. 124. 1845.

ASCLEPIADACEAE

Asclepias linaria Cav. Ic. 1:42. 1791.
Marsdenia spp.

CONVOLVULACEAE

Dichondra argentea Humb. & Bonpl. ex Willd. Hort. Berol. 2: 81. 1806.
Evolvulus alsinoides L. Sp. Pl. ed. 2. 392. 1762.
Evolvulus prostratus Rob. Proc. Am. Acad. 29: 320. 1894.
Evolvulus rotundifolius (S. Wats.) Hall. f. Bot. Jahrb. 16: 530. 1893.
Evolvulus sericeus Sw. Prodr. Veg. Ind. Occ. 55. 1788.
Exogonium bracteatum (Cav.) Choisy ex G. Don, Gen. Hist. 4: 264. 1838.
Ipomoea costellata Torr. in Emory, U.S. & Mex. Bound. Surv. 2, pt. 1: 149. 1859.

Ipomoea intrapilosa Rose, Gard. & For. 7: 367. 1894.
Ipomoea murucoides R. & S. Syst. Veg. 4: 248. 1819.
Ipomoea stans Cav. Ic. 3: 26. 1794.
Ipomoea wolcottiana Rose, Gard. & For. 7: 367. 1894.
Ipomoea spp.
Quamoclit spp.

POLEMONIACEAE

Loeselia amplectens (Hook. & Arn.) Benth. in DC. Prodr. 9: 320. 1845.
Loeselia coerulea (Cav.) G. Don, Gen. Hist. 4: 248. 1837.
Loeselia mexicana (Lam.) Brand, Pflanzenreich IV. 250 [Heft 27]: 174. 1907.

BORAGINACEAE

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Huejuquilla
Jerez
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San Juan de los Lagos
Yahualica
León
San Francisco del Rincón
San Blas
Tepic
Compostela
Ixtlán
Valle de Banderas
San Sebastián
Puerto Vallarta
Mascota
Tequila
Tepatitlán
Arandas
Manuel Doblado
Guadalajara
Ameca
Ocotlán
La Piedad
Cocula
Jiquilpan
Zamora
Tomatlán
Autlán
Villa Carranza
Ciudad Guzmán
Los Reyes
La Huerta
Tecalitlán
Colima
Tepalcatepec
Manzanillo
Apatzingán
Tecomán
Cerro de Ortega
Coalcomán

LEYENDA

- BOSQUE TROPICAL SUBDECIDUO
- BOSQUE TROPICAL DECIDUO
- BOSQUE ESPINOSO
- MATORRAL SUBTROPICAL
- ZACATAL
- BOSQUE DE PINO Y ENCINO
- PALMAR
- MATORRAL CRASICAULE
- CUERPOS GRANDES DE AGUA
- CONTORNO DEL LITORAL Y LIMITE DE ESTADOS
- LIMITE DE TIPOS DE VEGETACION
- POBLACIONES CITADAS EN EL TEXTO

MAPA DE VEGETACION DE NUEVA GALICIA

ESCALA GRAFICA

0 5 10 15 20 25 Km

1966

NOTES ON THE DISTRIBUTION OF WEST INDIAN MARINE ALGAE PARTICULARLY IN THE LESSER ANTILLES

With a Bibliography of Recent Works on Eastern American Tropical Algae

by

Wm. Randolph Taylor

CONTRIBUTIONS FROM THE UNIVERSITY OF MICHIGAN HERBARIUM

Volume 9, No. 2, pp. 125–203, 26 text-figures, 8 plates

University Herbarium, University of Michigan

Ann Arbor, Michigan

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Rogers McVaugh, *Editor*

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WM. RANDOLPH TAYLOR

University of Michigan

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INTRODUCTION

The Caribbean marine algal flora has interested me at least as long as has that of New England. Indeed, stemming from my Florida studies a general manuscript was compiled over 40 years ago, and only after many revisions did it appear in print. While revisions were in process it became obvious that the distribution of these plants was very poorly documented. Many of the early records give no more precise locality than "West Indies", or, where an island is mentioned no local site appears. The mainland shores in particular have been largely neglected, though Florida, Texas and to some extent the northern coast of Brazil have received a little attention. To remedy the lack along these particular coasts was beyond my power, but the Antillean chain appealed as offering readier points of access.

Useful accounts of the algae of the Bermudas (Collins & Hervey 1917, Howe 1918) and the Bahamas (Howe 1920), of the former Danish West Indies (Børgesen 1913-20), of the French islands (Mazé & Schramm 1870-77, Questel 1951) and of Barbados (Vickers 1905, 1908) have been published. I have myself made extensive studies of the Bermudian marine flora during many visits, and a substantial one of Jamaica. My early knowledge of the floras of the other islands had mainly been acquired through study of collections made by correspondents. Often these collections were of considerable size, and I have reported on them individually, Haiti in particular (1929, 1943). Others were small and simply became for the time herbarium records, but all helped document the algal distribution accounts significantly. All were incorporated in my general account of the tropical marine flora (1960), where there is given a brief historical survey of the marine botanical work in the region. Yet, for the most part, the algal records through the Lesser Antilles remain scattering, and generally without station records. It was desired to correct this.

During the winter seasons of 1966-67-68 several islands were visited and extensive collections made. For some of them, as Grenada and Barbados, these are complementary, for others, like St. Vincent and Bequia, they appear to be the first records of any sort. In this paper I include a very few reports of algae from Bermuda and Grand Bahama, as they are timely and important, though those islands are out of our general range. A considerable number are reported from Grand Cayman also, to supplement collections received from G. R. Proctor, but the great majority of the records listed are from the Lesser Antilles. An extended report of the algae of Jamaica appeared not long ago (Chapman 1961, 1963) and one of the island of Trinidad is known to be in preparation. Descriptions of the marine vegetation of the Netherlands islands has recently appeared (Vroman 1968). While the listing of algae from the smaller islands is manifestly incomplete, and some of the very small ones (Anguilla, Cayman Brac, Carriacou for instances) have been neglected, this leaves the large islands of Cuba, Puerto Rico and Hispaniola (or at least the Dominican Republic) as major subjects for future study.

It is not possible to acknowledge individually all who have generously helped with this study. Much of my scientific expense was met by a grant from the National Science Foundation (GB-3186), for which essential and most welcome help thanks are gratefully rendered. This included field and laboratory needs, assistance, and on Barbados research space, as well as at the Marine Biological Laboratory, Woods Hole, Mass., where time was divided between New England studies and this project, for facilitating which its superb library was most necessary. For the loan of herbarium material for comparison with my collections, hearty thanks are due to the Directors or Curators at the U.S. National Museum, the New York Botanical Garden, the University of California at Berkeley, the

Farlow Herbarium of Harvard University, the Naturhistoriska Riksmuseet, Stockholm, the Universitets Botaniska Museum, Lund, the Rijksherbarium, Leiden, the Science Museum, Kingston, Jamaica and to many others whose help, though less direct, is equally appreciated. For preparing the latin diagnoses I am indebted to Dr. Hannah Croasdale, of Dartmouth College.

The first set of the specimens of algae which I collected in 1966-1967-1968 and which I have reported in this paper has been deposited in the Herbarium of the University of Michigan, with the exception of those from Dominica collected by me or by Mr. Rhyne, where the most complete set has been placed in the U.S. National Herbarium, Smithsonian Institution, Washington, D.C., and the second in that of Michigan. Specimens from other collectors are also in the Michigan herbarium except as noted.

While indications of those residents who on certain islands gave particular assistance will be given when those islands are discussed, it is appropriate to say here as well as in more detail later that the Smithsonian Institution sponsored the Dominica visit, and that the Bellairs Institute of McGill University not only allowed me to make that laboratory my base for work on Barbados and for correlating work elsewhere, but that its Director, Dr. John B. Lewis, gave graciously and unstintingly of time and attention to my problems, and by his intimate local knowledge guided me promptly to workable shore areas.

By no means least must be my expression of gratitude to my wife, Jean Grant Taylor, for whom these trips theoretically were vacations, but who in practice drove our rented cars over all but the most dangerous roads, coped with the complex local postal regulations, and with the clerks to whom scientific shipments were rather suspect, located detailed official land maps in obscure government offices, made local contacts which developed into information centers, coaxed native dishes from cooks who considered them too much trouble, found in crowded or curbside markets fruits and vegetables to extend the local concept of tourist dietary, and in general "ran interference" for me so that the routine of collecting and drying specimens could be effectively crowded into our short visits.

GRAND BAHAMA 26-28 Feb. 1968

A general study of Bahaman algae was not planned for the visit of 25 Feb.-1 Mar. 1968. A little shore collecting was done near the Grand Bahama Hotel and toward Settlement Point. On the *Thalassia* flats near the hotel in the area known as the West End *Halimeda opuntia* was generally the dominant alga, although *Enteromorpha flexuosa* and *E. plumosa* prevailed in some spots. About Settlement Point and West End Village *Monostroma oxyspermum* was the most prominent alga on the rocks, and there was a good deal of *Bostrychia tenella* on the mangroves.

The feature of particular interest in the area appeared on the gently sloping beach-rock shores along the southwest side not far from the hotel property. Here in the conspicuous tide-pools and rocky shoals grew an abundance of luxuriant *Cystoseira myrica,* the plants reaching heights of 30-40 cm. This species has long been known from the Bahamas: Grand Bahama, New Providence, Rose and Berry Islands and Gun Cay, though its further distribution in the areas is as yet undetermined, and the museum specimens I have seen have all been small. It is also known, though much less well, from Florida, whence good specimens have lately come to hand. This until recently (Taylor 1961) was the only species of the genus known from eastern America, but we now know that *C. fimbriata* (Desf.) Bory grows in the Bermudas, probably as a recent introduction.

GRAND CAYMAN 16-25 Jan. 1968

The Cayman islands have not been altogether neglected phycologically, particularly Grand Cayman. Collections made there by George R. Proctor and others have been seen, and for the island nearly 50 species and varieties were recorded in my general catalog (Taylor 1960), but I am now able to add about as many more.

The western coast of Grand Cayman alternates long sandy beaches with areas of beach rock and limited inshore shallows. With the proliferation of hotels and residential clubs along this coast its natural character is rapidly disappearing. Algae were washed ashore in considerable variety during our visit. The little rocky promontories bore only a moderate algal growth, of which the most distinctive element was *Turbinaria,* which grew along the outer margin of the rocks just below low tide, both species being represented. There was a good deal of *Bryothamnion triquetrum,* of *Galaxaura* and *Spyridia aculeata,* but *Gelidiella acerosa* and *Digenia,* which were to be expected, were stunted and overgrown with epiphytes, while beneath all these the vegetation of close turf-forming species showed no one kind as particularly conspicuous.

The south shore showed some beach areas, some accessible beach rock shoals, but the most distinctive algal regions were the broad sea-grass shoals of South Sound near Red Bay. Here *Thalassia* dominated offshore, *Halodule* nearer low tide line. There were fine patches of *Caulerpa sertularioides,* otherwise very scarce about the island. Common plants were *Avrainvillea longicaulis, A. nigricans* and *Penicillus capitatus.* The seldom-seen *Chrysophaeum* occurred here also, as a considerable range extension. Great loose masses of *Halimeda opuntia* were abundant, likewise *Cladophoropsis membranacea.* As usual in such an environment the variety of species was small, but the luxuriance conspicuous.

The shores near Boddentown and, further eastward, Gun Bay Village, were good for rocky shoal species. However, the long stretches of sharp, intricately eroded rock,

especially toward the east end of the island as usual yielded little of interest. Rocks somewhat less difficult of access near Savannah and West Bay Village on the north shore bore *Petrosiphon adherens,* a plant very rarely reported. Probably the area most meriting careful study is North Sound, for which I lacked a suitable boat and helper. For instance, the algal associates of the mangrove thickets could be determined, and there should be a variety of Gracilarias, Hypneas and Eucheumas, perhaps Halymenias, in somewhat deeper water. At the Georgetown Embarcadero where a road gave me access I found on a rotting skiff a luxuriant growth of *Bryopsis halliae* and the alga-like animal *Ascothamnion,* with some good plants of *Dasya pedicellata,* commonly ill-grown in the tropics. More toward the entrance at Botabano, Proctor some years ago collected quite a variety of species characteristic of sheltered waters, so the area is probably a rich one.

It is dangerous to state on short acquaintance that some species generally common are not so on a given island, yet it is indeed remarkable that *Cladophora fascicularis* and *Colpomenia* seemed absent, attached Sargassums, Janias, Corallinas and *Caulerpa racemosa* scarce. On the other hand, *Cladophora fuliginosa* was more common than on those of the small islands further east which were visited. All of these are forms with very wide ranges, and the suppressive conditions seem to be local. These cannot, however, be due to the discharge of fresh water, since the island is very low, scarcely reaching an elevation of 20 meters, and there are no significant streams.

ST. CHRISTOPHER 2-5 Mar. 1968

This island, in the Antilles universally referred to as St. Kitts, is one of those which has escaped phycological study. The interior is rugged, and practically devoid of roads. A high central ridge is dominated by two chief peaks, one reaching an elevation of over 1100 m., with a crater lake on a shoulder of the more northern one. A rough marginal road does, however, run around the island, though only partially near the shore, so that most of the beaches (except on the southeast peninsula) could be reached by car were the feeder lanes not so difficult.

The coast is mostly precipitous, and even where the maps show no cliffs, not really accessible. Sandy shores shown on the maps, as in St. Thomas Middle Island Parish, frequently yielded no drift algae. In fact, no successful collecting was done on the west side of the island: reefs productive of algae were not in evidence offshore. There was, however, a considerable drift of shoal and reef algae coming ashore at Dieppe Bay on the north, and an abundance on the seines of fishermen working over these shoals. At Black Rocks near Belle Vue on the northeast I met the feature, unusual in these islands, of young volcanic rock as a substrate, but the heavy surf prevented much collecting. The intertidal area could be seen to be dominated by a brown crust, probably *Ralfsia,* mixed with patches of a dwarf *Laurencia.* The uppermost zone of mossy algae was of *Bostrychia binderi,* while brown tufts and felted filaments were characteristic of the lower splash zone, and nearer the water's edge at low tide a mat composed of *Centroceras* and other filamentous types supported tufts of *Wrangelia.*

At Conaree Beach on the southeast a long stretch of dark sand is interrupted by a few areas of accessible beach rock, with bracket corals conspicuous offshore. Washed ashore were quantities of *Sargassum vulgare, Bryothamnion triquetrum* and *Laurencia papillosa.* On the rocky shoals *Chondria littoralis* was common, as was *Gracilaria sjostedtii,* particularly on the rocks buried in the sand. Still further to the southeast the land is drawn out into a jagged peninsula, and this tip provided the most productive shores. It was not practicable for me to get to Cockleshell and Majors Bays, which might have been very fine. However, Frigate Bay on the southwest side and North Frigate Bay on the northeast side served very well. The former at the rocky Fort Tryon end showed a conspicuous intertidal vegetation of very yellow *Laurencia papillosa.* Somewhat lower in

the intertidal area there was a lot of *Dilophus guineensis* and *Dictyota ciliolata* among the clumps of *Sargassum platycarpum*, but most of the area was covered with a mat of minute species. Across the peninsula from this bay was North Frigate, which proved exceptionally fine, not directly at the point of access but some distance to the north, where there was an exposure of beach rock with pools. The shore drift on the sand was chiefly of *Cymodocea,* associated with which (in contrast to *Thalassia*) I have seldom found many algae. This came from sandy shoals, of course. The rocky areas were in great contrast. By far the most striking thing was the large amount of the quite rare *Caulerpa webbiana* forming soft felts in the pools. Around these the rocks were richly tufted with *Gracilaria debilis, G. ferox,* very yellow *Eucheuma gelidium* and bright green *Ulva fasciata.* There was an inconspicuous undergrowth of compact *Halimeda opuntia,* and *Chondria littoralis* was abundant where there was some sand on the rocks.

NEVIS

6-12 Mar. 1968

Somewhat smaller than St. Kitts, the island of Nevis is quite similar in many respects, such as topography and phycological neglect. There is a single central mountain peak of about the same height (about 1000 m.), with access by road limited to the lower marginal lands which, however, are broader in proportion. The main circular road lies somewhat back from the shore except on the northwest, and particularly far inland toward the south, where there are broad derelict estates with badly eroded service lanes. The shore could be reached at a few beaches, but no really good beach rock or inshore reef collecting presented itself.

Immediately beyond the little capitol, Charlestown, a superb beach runs north for over 4 km., backed by a fine grove of coconuts, dominating the west side of the island. This Pinneys Beach, being immediately accessible, was carefully worked over and algae in moderate variety were found washed ashore, though very small in quantity. On the few large rocks *Chaetomorpha media* formed the most obvious growth. Things most common in the drift included *Gracilaria debilis, G. damaecornis* and *Dictyota indica.* Further north at Jones Bay a heavy *Thalassia* drift carried with it a profusion of Dictyotas, particularly *D. dentata.* Nearby Mosquito Bay showed abundant *Enteromorpha clathrata* on the few rocks and a substantial variety of Rhodophyceae, particularly frequent being clumps of *Lophocladia* and of *Codium isthmocladum.*

The Sea Haven Estate shore near the airport on the north carried a substantial drift of *Thalassia,* Sargassums and Dictyotas. There was a good deal of *Liagora farinosa,* of *Dictyosphaeria cavernosa* and *Valonia ventricosa.* The special rarity was a scrap of *Caulerpa ashmeadii.* No useful collecting areas were available along the east side until we reached the southeast limit where, by a long, dangerously eroded lane we came to the Indian Castle Estate, now an experimental station. Here there was a heavy surf running on the beautiful shore outside of the coconuts. The marine drift was composed of a great mass of *Cymodocea,* but with it considerable *Dictyopteris justii,* much *D. delicatula* and a variety of Dictyotas. Sargassums constituted a moderate proportion of the drift, particularly *S. natans,* but only Phaeophyceae were in significant quantity. The lanes to the other old estates around the south and southeast shores were so bad that access by car was not feasible, so no collecting was done here.

ANTIGUA

27-31 Mar. 1966; 29 Jan.-12 Feb. 1967

Antigua, like Jamaica and Barbados, has long been a major center of business and culture among the former British West Indian colonies, and was a naval base at one time, but scientific efforts there did not involve botany in a major way. It is a moderately low

island, less elongated than some of the Lesser Antilles, being about 18 by 27 km. Boggy Peak reaches a height of about 400 meters. The shoreline is deeply indented in many places. Even before the advent of steam its importance as a naval base waned; an increasingly dry climate has almost extinguished the sugar and rum enterprises which at one time had much of the land under cultivation. All of the island now seems dry, although coconut trees and others demanding moderate moisture can be seen to flourish in the Fig Tree Hill area of the southwest, whereas other areas like that in the extreme east toward Devils Bridge Point (Indian-Town Point), beyond Willikie Village, carry an acacia-cactus scrub under extremely dry conditions. Access to the shore is unexpectedly limited because there is no peripheral road near the coast, except briefly on the southwest. If a small launch were available the island could be easily and closely studied from offshore.

It is unfortunate that the botany of the island was not early and thoroughly studied. For the land flora this is particularly disappointing because too little is known of what was the flora before the cane fields destroyed it. Here we do not have the equivalent of the Gullies and Turners Woods of Barbados to retain a bit of the original flora. In particular the marine algae have been neglected, and only about 15 species were recorded before 1960, and some 10 added in my 1962 paper. Our two short visits to the island brought the total to over 135, confirming practically all those previously recorded except *Pachychaeta griffithsioides,* for which this has been considered the type locality.

Since the shore is usually to be approached by roads leading down to it from the inland complex rather than paralleling it, they commonly terminate at sites occupied by hotels and beach clubs, military or commercial installations, and this limits collecting activity. On the north shore beyond the capital town the first good collecting sites were near Wetherell Point and Soldiers Bay, especially the former. Here there was a good and varied growth of algae on the rocky reef at the east end of the beach. Between tide marks *Enteromorpha lingulata* covered some rocks, *Polysiphonia howei* was frequent a little lower, followed by Galaxauras. At about 5 dm. depth *Dictyota ciliolata* was common. The item otherwheres rarest was *Cymopolia,* present in small amount in 1966 and not otherwise found on these trips. The pelagic Sargassa were present in 1967. Less notable was the vegetation at Soldiers Bay, but *Falkenbergia* was abundant on *Laurencia papillosa* and *Digenia.*

Our base being at Hodge Point the nearby shore was checked almost daily. It was not very rich, though the rocky shelves eventually yielded a number of things.. In 1966 *Pocockiella* was washed ashore in abundance, but not in 1967. High on the rocks *Dichothrix* was evident, lower in the crevices there was much *Dictyosphaeria vanbosseae,* and near the seaward edge, a good colonization of *Turbinaria*. There were small beds of *Thalassia* along the shore, associated patches of *Avrainvillea rawsonii*, and dwarfed *Penicillus capitatus.* Further east at Judge Bay there was usually a richly varied wash coming ashore, dominated by Dictyotaceae, but a good deal of *Falkenbergia* and many fragments of *Martensia.*

Much of the northeast area is occupied by U.S.A. military installations and unavailable, but the shallow harbors are probably rich in algae, for at Fitches Creek where the highway reached the shore there was a great deal of *Padina,* and Parham Harbor should be a fruitful region for study. Again, there are islands off shore, and yet more to the eastward many small covers and reefs, where a boat could be used to good effect. Trips to Devils Bridge were taken, but there the shore was too precipitous for collecting; the adjacent Fanneys Cove on the other hand was a profitable site, yielding *Bostrychia tenella, B. rivularis* and *Bryopsis plumosa,* none common on Antigua.

While the south shore doubtless is as rich as the others only one place visited is

notable. Mamora Bay appears to be a favorite area for the "moss" fishermen, and remnants of their *Eucheuma isiforme* harvest were common along the shore. With it were masses of *Halimeda opuntia* and *Centroceras.* On the northwest several small bays were visited: Pinchin Bay, Goat Hill Bay, Rocky or Pull-and-be-Damned Bay, and Hog John or Loblolly Bay in particular. All yielded modest returns, and at a time of onshore winds might be very rich.

The harbor area of St. Johns was not in general favorable territory, but at the time of my visits a long causeway ran out to a little peak called Rat Island, and the rocky shallows on each side of the causeway were very richly covered with algae. Truncation of the island and widening of the causeway to develop a shipping facility may have ruined the immediate area, but probably a similar vegetation exists on the northern shores of the harbor called The Cove, whereas on the near south side in front of the town pollution is already heavy. Along the causeway and lateral to it within view the algal growth on the rocks was spectacular. Phaeophyceae were not conspicuous. The major constituents among Rhodophyceae were *Gracilaria sjostedtii, Agardhiella tenera* and *Centroceras* in abundance near the surface, with occasional clumps of *Pterocladia americana* and *Grateloupia filicina.* While *Ulva fasciata* was present at a high level, the abundant Chlorophycean was, most unexpectedly, *Caulerpa scapelliformis* with blades to 2 dm. long in large masses on the rocks just below low tide level. This is, of course, a new record for the alga, and as a range extension slightly more northern than its recorded occurrence on Guadeloupe (Taylor 1967).

The possibilities of the island for algal study were suggested to me by Dr. Waldo L. Schmitt, and Mr. Paul Denckla, who has long been resident on the island, and collected some algae there (Taylor 1962), was indefatigable in making arrangements for my work. In introducing me to interesting areas his friend Mr. Frank H. S. Warneford was also most helpful, and to all of them hearty thanks are due.

MONTSERRAT 10 Feb. 1967

A visit to this island was made to see how practicable it would be to secure a general collection of the marine algae of its coast. It was found possible to approach the shore by car at few places only, and when reached, collecting was not possible. The shore-line in general was too precipitous, too rough for me to work. A younger person, guided and assisted by a sympathetic local resident, might have done somewhat better. Perhaps from a boat some sheltered spots might have been reached, but this would have required exceptionally favorable weather. At Woodlands Beach the intertidal rocks were green with *Enteromorpha flexuosa,* but nothing else was accessible.

DOMINICA 16 Feb.-13 Mar. 1967

As it is expected that Dominica will be the subject of a separate and much more detailed report, conditions there will be treated very briefly here, although careful observations were more practical than on some of the other islands. Dominica is, botanically, extremely interesting, the land flora relatively well preserved. Rising to an altitude of over 1400 m., the highlands are heavily forested thanks to the ample rainfall, though not readily accessible above the passes. Tree ferns are abundant at moderate altitudes and even near sea level the fern vegetation and masses of epiphytes on the trees are conspicuous. This terrestrial vegetation has been thoroughly described (Hodge 1954), but much of the cryptogamic botany has been neglected.

The west coast shores are not particularly favorable for algal growth. However, there were exceptional local areas. The shallows beyond the north or Soufrière Bay Shore of the peninsula to Scotts Head provided a good site. The rocks at high tide level were covered

with *Chaetomorpha nodosa,* and a bit lower *C. media* replaced it. *Ulva fasciata* was common, and locally also *Ectocarpus breviarticulatus, Giffordia mitchellae,* and *Gelidiella acerosa,* with *Ralfsia* discoloring large areas of otherwise bare rock and *Sargassum vulgare* supplying clumps dominant by their height. The variety of other things was considerable on this side, but on the more exposed south shore, while the intertidal area was uninteresting, there was a substantial *Sargassum-Dictyota* vegetation below the zone of chief wave force.

In the capital town of Roseau itself the shore could be reached directly in front of the postoffice, and followed somewhat southward from it. Even with heavy pollution algal growth on the rocks was luxuriant, particularly on the great rocks rising above the cobblestones and more resistant to the heavy surf. While there was *Chaetomorpha nodosa* high on some rocks, the most evident abundant green alga was *Ulva fasciata,* which grew a bit lower. Very common also was *Gymnogongrus tenuis; Grateloupia filicina* and *G. cuneifolia* were hardly less so, and there were numerous other algae so that the flora was most interesting.

For the most part collections northward along the west coast were of seaweed washed ashore, and as the road followed the coast closely opportunities were numerous north as far as Macoucherie, but not practicable further. Where large rocks did stand up and maintain a plant cover it showed the usual cap of *Chaetomorpha nodosa* above *Enteromorpha, Ulva* and various small species. In quieter areas the cobbles themselves bore considerable quantities of Padinas, Gracilarias (notably *G. domingensis*) and *Hypnea musciformis.* The coast again became accessible north of the old capital Portsmouth, both at Lagon on Prince Rupert Bay and Tanetane on Douglas Bay. These were quiet, rather shoal areas, the latter richer in algae. Dictyotas, especially *D. ciliolata,* were unusually common; so was *Wrangelia argus.* Among more rare items that also were common here were *Pterocladia bartlettii* and *Liagora decussata.*

Roads did not circle the north tip of the island, so it was not investigated. On the northeast limited access was possible and collections were made at Calibishie and a bit eastward at Woodford Hill Bay. Both were good sites. At Calibishie offshore reefs provided a heavy drift of weed on the shore and a chance to secure attached material to correspond. Abundant were large jelly-like digitate masses of a colonial diatom, which was kindly identified by Mr. Robert Ross, Keeper of Botany at the British Museum (N.H.) as *Amphipleura micans* var. *fragilis* (Grev.) Cleve. There was a substantial rock cover of *Pocockiella,* lithothamnia, *Amphiroa fragilissima* and in spots *A. rigida* var. *antillana* on the reef near shore. With it *Ulva fasciata, Gelidiella acerosa, Digenia, Laurencia corallopsis,* Gracilarias and *Bryothamnion triquetrum* constitute the bulk of the vegetation.

Almost the whole east side was unavailable, the roads where open suitable for jeep travel only, except at Rosalie where a collection was made. It was not a good site, the river probably having some effect, and the cobble shore being unsuitable under heavy surf. There was more variety of drifted Sargassums here than usual on Dominica, but on the rocks little more than Enteromorphas and *Grateloupia filicina.*

Particularly favorable facilities were available on Dominica, for the Smithsonian Institution of Washington most graciously arranged for complete field support based on the station set up for the Bredin-Archbold-Smithsonian Biological Survey at Clarke Hall on the Layou River. Needless to say we are most grateful to the sponsors of the Survey and the Institution. Furthermore the Smithsonian assigned as collaborator Mr. Charles F. Rhyne of its staff to make advance arrangements, work with me during my visit, and continue afterwards to collect in new areas. On all occasions his help was very material and generously given.

ST. LUCIA 16-26 Mar. 1968

This island afforded better rocky-shore collecting than most others visited in 1966-68. It is quite high throughout the central part, though little exceeding 900 m. Two main roads cross the high land toward the north, and several very secondary roads cut well into the high country. A peripheral road serves much of the coastal lower land, but not the northeast sector. The shore is chiefly rocky with numerous bays and good beaches, especially on the northwest side.

LaBrellotte Bay is a good example of these. At intervals it is interrupted by rocky outcrops which are easily worked upon, and in some places there are small sea-grass shoals near shore. While each outcrop when visited had a little different flora from the others, some features were rather general. Near high-tide line there was an *Ectocarpus*-zone with *E. duchassaignianus* a bit above *E. breviarticulatus.* Below, Padinas were conspicuous, mostly dwarf, and in turn below these abundant *Dilophus guineensis* appeared on some outcrops, not on all. Tufted things common but scattered about include *Hypnea musciformis, Gelidiella acerosa* and *Galaxaura squalida.* At very high tide levels some rocks were topped with *Chaetomorpha nodosa* and *Ectocarpus breviarticulatus, Spyridia aculeata* and *Centroceras* coming in a bit deeper, as near Cap Pointe toward the north end of the island.

The harbor of Castries if studied in detail would yield a good variety of forms characteristic of moderately polluted water. Where sampled near numerous fishing boats the harbor wall bore in quantity *Ulva fasciata,* with *Centroceras* and *Spyridia aculeata* a bit deeper. Further south at La Toc beyond the polluted area I made one of the most surprising finds: a large population of *Brachytrichia quoyii* with, of course other items. Still further south at Grande Cul de Sac there was a conspicuous vegetation of *Sargassum* on the offshore rocks and of *Enteromorpha clathrata* intertidally. A variety of things were being washed ashore here, notably much *Siphonocladus tropicus* and the extraordinary *Gracilaria crassissima* in large pads.

While the southern bays looked very promising, time for collecting there could not be arranged. On the southeast the shore was seldom accessible from the road, but by boat should give very good hunting. A notable mangrove-bordered lake near Savannes deserves study. A visit across the northern part of the island to Grand Anse Bay found a great beach pounded by heavy surf, almost without drifted algae other than a few *Sargassum* plants, though the rocks at the boundaries showed the usual *Laurencia papillosa-Gelidiella acerosa* vegetation, but little else. An attempt to reach nearby Marquis Bay failed, a hurricane and subsequent tangled shrub growth having destroyed the access road, but collections had been made there by G. R. Proctor ten years ago (Taylor 1962, p. 46).

BARBADOS 14 Feb.-8 Mar. 1966
4-15 Mar. 1967; 30 Mar.-5 Apr. 1968

Except for Guadeloupe, of all the Lesser Antilles the island of Barbados is from a phycological standpoint historically the most interesting. Studies on the French islands were earlier by a quarter century or more, but the large proportion of names used which are not acceptable by modern standards limits the usefulness of the Mazé and Schramm account (1870-77). For Barbados the more conservative treatment and attractive illustrations by Vickers (1905, 1908) are more satisfactory. Never-the-less there are a few novelties described by her for which more material and fuller descriptions are still desired and though this feature was one of the first to focus my plans on this island I found that general observations outweighed in importance and practicability a search for her special types in the field, and in this respect little was accomplished. On the other hand a very substantial increase in the list of algae recorded from the island was effected, over 50

species, whereas about 70 previously recorded were not found on these occasions. That some should not be noticed is not surprising in view of the irregular appearances of the scarcer marine algae everywhere, and, of course, some of the old records are of very uncertain worth. The total of seaweeds recorded is now over 230, exclusive of Myxophyceae, and this could certainly be substantially increased were attention focused on the small and microscopic species.

Barbados is by no means possessed of the broadest range of tropical algal habitats. Its characteristic coasts are exposed ones, and a large proportion of the shore is rocky, sometimes limestone cliffs, sometimes quite low, but eroded into most abrasive ridges and spurs, sometimes of sloping beach rock, but relatively lacking are sheltered coves, mangrove-bordered coves, land-locked marine lakes, or shores with extensive tide-pool areas. Sea-grass meadows are present, but not extensive, and they, like other productive areas of sandy or muddy bottom, have little protection from offshore reefs. The relative completeness of its algal list is, therefore, due to the degree of attention devoted to these plants about the island, rather than intrinsic richness.

Barbados, in contrast to its neighbors, is a relatively low island, but of rolling terrain with occasional dry stream valleys or gullies. Both the northern and southern ends are comparatively flat; otherwise some distance from the western shore the land rises sharply between approximately the 120 m. and 150 m. contours, and continues to rise until toward the northeast portion an altitude of about 340 m. is reached at Mount Hillaby in the Scotland District of steep hills. Beyond these the descent to the marginal lowland along the east coast is quite steep, sometimes continued to sea level, as along the coast north of Cattle Wash, but frequently ending in cliffs at the shore. Although the land itself is not very high, cliffs constitute the shore line along much of the south and southeast as well. Because of the complex but well-marked road system almost all portions of the shore are accessible at frequent intervals.

It did not prove feasible to collect about Bridgetown Harbor; doubtless pollution has a major role in limiting the flora there. A more suitable habitat was available on the artificial foreshore established with massive rocks to protect the roadway seaward from the tourist center called Pelican Village northwest of the mercantile area, beyond the newer deep-water harbor. The rocks at the upper intertidal limit were covered with *Ulva fasciata* in a narrow belt, below which there was a broader one of *Chaetomorpha media.* Near its lower limit very soft black tufts were conspicuous which proved to be *Bryopsis pennata.* Less common, with the *Chaetomorpha,* was *Gymnogongrus tenuis,* also forming dark but more wiry tufts.

It became quite clear on my first visit that the west coast was not going to be the richest one for algae. Without reef shelter there was little sea-grass, little on the narrow sandy shoals, and on beach rock reefs running out from the shore there was a close algal growth, but of small species. As a first result of conditions it was found that no collecting between Bridgetown and Holetown was useful. On to the sand near the Bellairs station and neighboring beach clubs little came ashore, but divers in relatively shallow water brought in fine plants of *Liagora mucosa* and a few other things, but reported no major vegetation. Some tentative dredging at a few meters' depth was profitless, though with adequate heavy equipment and more persistence something might have been accomplished in spite of the troublesome coral masses.

The chief useful algal sites along the northwest coast were the beach-rock ledges found at frequent intervals near Paynes Bay and from Heywoods Beach to Six Mens Bay. At Paynes Bay occasional rock ledges occur which are largely exposed at low tide. On the main reefs the inner portion had a dominant *Enteromorpha* belt, the outer portion one of dwarf *Sargassum* with *Gelidiella acerosa, Padina* and *Cladophoropsis* which continued

over the upper rock surface with much less *Sargassum,* but *Dilophus guineensis* and dwarf *Acanthophora spicifera, Wrangelia argus* and Myxophyceae (especially *Lyngbya majuscula*) join the still more-dwarfed Padinas. It is curious how different areas seemingly identical in exposure are respecting their floras. A nearby ledge showed a good deal of *Ulva fasciata,* yet another not much lower had a great deal of *Giffordia duchassaigniana* instead along the inshore margin. Near the north end of the beach there was a small growth of *Thalassia* in the sand, and the chief alga associated with it was *Padina vickersiae.*

At Heywoods Beach and Six Mens Bay the beach rock similarly ran out into deep water. The inner margin again was marked by a green *Enteromorpha* band, but large areas were covered by black Myxophyceae, notably *Lyngbya majuscula.* The general dwarf vegetation was much as at Paynes Bay, but Galaxauras and *Centroceras* were more prominent, instead of *Acanthophora.* Again there were local areas of different dominance, for instance one considerable area almostly solely covered with dwarf, unidentifiable Dictyotas. On the border toward the sea *Chaetomorpha media* was abundant, with *Ectocarpus breviarticulatus* very common near high tide. These are, then, characters of the vegetation on an unprotected coast, but one not, at the times of my visits, a coast subject to severe wave action.

In great contrast one may consider the conditions at River Bay and Little Bay on the northeast coast. They are approached through gaps in stern cliffs which show superb examples of fossil corals, especially at River Bay. Wide rock shelves extend out to deep water; except on rare occasions thunderous surf pounds upon them. The general dominant genus is *Sargassum,* especially *S. platycarpum,* developed splendidly in the sheltered rock clefts and sheltered pools, but otherwheres stunted. The close rock-surface growth of *Ectocarpus, Giffordia, Gelidiella, Centroceras* and *Laurencia* was similar to that elsewhere, but more varied in detail of associated species. The whole area of each bay was rich in these dwarf forms, and their more fully developed phases in the rock crevices, but deserved far more attention than I could give them.

Certain special features deserve brief mention. River Bay received an intermittent freshwater drainage. In 1966 the lower brackish part of the stream was densely filled with *Enteromorpha lingulata,* but in the other years it was not striking. At the end of the stream bed and behind the rock shelves there is a large pool with a maximum low-tide depth of about a meter. Here there was a good deal of *E. flexuosa* and numerous tufts of the unusual *Rosenvingea sanctae-crucis* in 1967. Just north of Little Bay there was a high tide pool quite inaccessible under ordinary circumstances, but in 1967 at a period of low tide and calm it was reached by skirting the foot of the high cliff. Doubtless much heated at low tide, it was in great part bare, but notable for conspicuous tufts of *Sphacelaria tribuloides* and much *Ectocarpus breviarticulatus.* Another peculiar feature appeared in 1968. I was locally assured that the pelagic Sargassa would not come ashore in the late winter-early spring, and in 1966 and 1967 this was true, but in 1968 I first found them, particularly *S. natans,* in quantity ashore in the bays of St. Lucy Parish, and later along the east coast generally.

The middle portion of the east coast is closely paralleled by a new highway and offers especially favorable stations for algae. Very long beaches are interrupted in shallow water by rock ledges with many sheltered pools and deep clefts. On a quiet day at low spring tides they are very accessible. On the seaward side *Sargassum rigidulum* dominates. The dwarf rock-surface flora is much the same as on the west coast. At low tide level *Codium intertextum,* scarce on these islands, did here cover the rocks in limited areas. Many deep tide pools were lined with *Avrainvillea rawsonii* and some with *Chamaedoris; A. nigricans* was frequent. Caulerpas, not particularly luxuriant about the island, appeared here in good colonies of *C. cupressoides, C. mexicana, C. racemosa* and *C. sertularioides.* Perhaps

the most striking element in the Rhodophycean flora here was *Corallina subulata,* which covered large, old plants of other algae in dense masses.

The old collecting stations of Vickers at Bathsheba, Bath and Conset Bay are still worthy, though the area just discussed is now more rewarding, except for algae drifted ashore. The grassy shoal at Bath Bay showed a notable colony of *Udotea cyathiformis* at a depth of somewhat over 15 dm. The drift coming ashore was heavy in 1966, less in the other years, but representative of the flora of offshore reefs. At both Bath and Conset a good deal of *Botryocladia occidentalis* was washed ashore, and also of the more rare *Haloplegma,* among a great variety of other things. These places, and especially Bath, were good stations for *Codium isthmocladum* (as the type locality) and *C. repens.* At Conset Bay drainage from the shore was reflected in a heavy growth of *Enteromorpha, Cladophora* and *Bryocladia cuspidata.*

Because there were few places where I could reach the shore on the southeast no useful observations were made. On the southwest from South Point in to Bridgetown there were, on the other hand, excellent conditions for algal growth and easy access. The rocky shoals at Oistins were richly covered, and algae in good variety were drifted ashore there and at several other stations. The most notable novelty at Oistins was the introduced *Caulerpa scapelliformis* (Taylor 1967) growing at low tide level in quantity in deeper crevices of the rock. While it occurred at Bath and Conset Bays, and at other stations nearer Bridgetown, this was the most striking colonization. It was not found on the east coast at all. Because of pollution there was a good development of *Enteromorpha* and *Cladophora* at Oistins, and a gradual transition to a vegetation of relatively pure water. A similar green mat of algae was prominent at St. Lawrence Bay.

At Gravesend-Garrison an extremely broad shoal extends out to a low reef margin, and gives a wonderful opportunity ıor observation at low tide. The algal cover is discontinuous, chiefly of *Hypnea* and *Padina sanctae-crucis* with much *Cladophora* east of the dyke. Especially to the west of it lubricous streamers of brown Myxophyceae were conspicuous, and small patches of blue-green species. Of larger algae the most interesting was *Caulerpa cupressoides* var. *lycopodium* moderately common in a large form. The last station along this coast worth mentioning was the shore east of the Hilton Hotel, nominally part of Carlisle Bay. Here Enteromorphas are already abundant, and the flora may become increasingly typical of polluted water.

In the Introduction mention has already been made of the particular helpfulness of Dr. John Lewis at the Bellairs Institute of McGill University in St. James Parish. Without his suggestions the location of field stations would have been much more difficult, and his cooperation like that of his staff at the Institute made work there especially pleasant. Dr. Melvin Goldstein and Mr. David Patriquin of McGill University were at the station in 1966 and about a third of the collections made on Barbados that year were made jointly with them, and this is specified on the labels of the pertinent specimens. A succession of students at the Institute brought in algae from ventures in scuba-diving, and supplied numerous handsome plants for mounting. The very intimate knowledge of the island, local customs and facilities possessed by Mr. and Mrs. Andrew Hammond was generously made available, and Mr. E. G. B. Gooding helped greatly in matters of interest respecting land plants. While this study was in progress a short paper on Barbados algae has appeared which includes five species (excluding Myxophyceae) not otherwise recorded (Almodóvar & Pagan, 1967).

ST. VINCENT 20-25 Mar. 1966

This island has practically been neglected from the standpoint of algal study, and this is not surprising in view of the few places along the shore easily reached by road. The

west coast is precipitous: a recent road of sorts now exists part way northward, but it is mostly high above the shore and dangerous, and the inaccessible interior rises to over 1200 m. There was little chance to collect; visits somewhat beyond Barrouallie were unproductive. At Barrouallie, which was the effective end of foray in that direction, rocky ridges separated 3-4 small beaches. The most distinctive thing on the rocks was *Grateloupia filicina,* which was associated with some *Gymnogongrus tenuis,* relatively scarce elsewhere. A rarity drifted ashore was *Rosenvingea floridana.* The variety available at Camden Park Bay was much greater, with Gracilarias and Dictyotas most prominent. South of Kingstown near the southern end of the island Calliaqua Bay was also productive.

On the east side of the island the road, coming from somewhat inland, first reaches the shore near Argyle, where the drift was dominated by *Dictyopteris delicatula:* in fact, this species and Sargassa together were the main features of the driftweed on the east coast. Peruvian Vale, a little to the north, again showed this *Dictyopteris* dominant, with *Spatoglossum, Amansia* and *Vidalia* as special curiosities. The species of *Bryothamnion* were practically absent from St. Vincent, but *B. seaforthii* was found in small amount here. The relative scarcity of Sargassa as washed ashore on the eastern beaches was also notable. Just a little further north at a place called Spring the rocks showed a large population of *Chnoospora,* quite an unusual feature and emphasizing the fact that some species of algae may be of very local occurrence in the tropics. By no means all are as regularly to be expected in appropriate situations as are *Enteromorpha lingulata, Digenia simplex, Laurencia papillosa* and *Centroceras clavulatum.* While we inspected the east shore as far north as Georgetown, beyond which the road was reported unfavorably, no other features of note presented themselves.

BEQUIA 22 Mar. 1966

For this quite small island I know of no algal records at all. Politically and economically dependent on St. Vincent, its population is small and the shore-line, except near the village landing, seems in a natural state. A visit of but a few hours was alone practicable, but upwards of 40 kinds of marine algae were recorded. A quick inspection of the village shore and of Princess Margaret Beach yielded nothing of interest. Conditions were better, at least for drifted material, on the northeast along the splendid beach at Friendship Bay, Lord Avon's former estate, which is now community property.

On the south shore an excellent area for attached algal growth was found in shallows toward Adams Beach. High on the rocks *Bostrychia tenella* formed its characteristic mossy growth, and somewhat lower there were dense mats of *Laurencia intricata.* Other common species included *Lyngbya majuscula, Cladophora fascicularis, Padina gymnospora* and *Acanthophora spicifera,* and while nothing which might be termed rare appeared, there was an impression of richness not often met about the high islands. Further study of this area, and of the Spring Bay region on the northeast shore, which I did not have time to visit, should be extremely worthwhile.

GRENADA 12-17 Mar. 1966

The algae of Grenada, it being an island accessible from Barbados and Trinidad, have received a considerable degree of attention, and a substantial list of over 90 species has been attributed to it. During our brief visit I was only able to add a dozen or so to the record. As usual on the high islands, this one rising to over 800 m., approaches to the shore are limited. For the most part the northern end could not be reached, and the main road on the east was generally quite far inland, while the west shore road was too high above the water to give ready access, and though we went as far as Charlotte Town we found nothing distinctive. In general, Sargassums and stunted Padinas dominated the rock

vegetation in the intertidal zone, with the usual undergrowth of *Laurencia papillosa* and other small species.

North of St. Georges at Grand Mal Bay a small assortment of driftweed was available. Just south of the town at Grand Anse we found a quantity of *Chnoospora* on the rocks of an isolated jetty, and a moderate drift, notably of Gracilarias. Inland a freshwater site at locally famous Annandale Falls was visited; the rocks were partly black-spotted, perhaps by Myxophyceae, partly red with *Hildenbrandia rivularis.* At the end of the southern peninsula under Point Salines, Black Bay provided a very varied drift dominated by Dictyotas and *Dictyopteris delicatula.* Not often seen in quantity, *Cryptonemia luxurians* was frequent along this black sand beach. Still on the south, a little further east it was possible to reach a mangrove thicket at Little Woburn, where *Murrayella* and *Caloglossa* were abundant, but neither *Catenella* nor *Bostrychia.*

On the east side, material was collected at Marquis and at Grenville a bit north of it. Most of the drift material ashore was *Sargassum,* but the associated variety was considerable. At the first station the most remarkable find was a specimen of *Halymenia duchassaigniana,* and at Grenville it was a large clump of the very broad *Dictyota dichotoma* var. *menstrualis.* The north side was reached by a road leading to a proposed real estate development at Levera Beach. On this shore the drift was scant and the inshore rocks rather bare, but the fortunate coincidence by which Mrs. Virginia Maes of the Philadelphia Academy of Natural Sciences was collecting algae for micromollusca on the outer reef by snorkel search, provided by her kindness ample *Caulerpa taxifolia, Enantiocladia, Cryptonemia luxurians, Dictyopteris plagiogramma* and other items from a rich vegetation, which tended to show that the offshore reefs about the island were quite as heavily vegetated as the drifted algae suggested.

ANNOTATED LIST OF SPECIES[1]

CHLOROPHYCEAE

ULOTRICHALES

CHAETOPELTIDACEAE

DIPLOCHAETE Collins, 1901

D. solitaria Collins:– GRAND BAHAMA: West End, southwest shore, epiphytic on *Callithamnion* sp., no. 68-28. GRAND CAYMAN: South Shore, Boddentown, no. 67-68 (on *Vaucheria*); West Shore, near West Indian Club, no. 67-91 (on *Cladophora*). DOMINICA: St. Mark Parish, Soufrière Bay, no. R-307B (on *Herposiphonia*). ST. LUCIA: Laborie Quarter, Laborie, no. 68-338C (on *Giffordia*). BARBADOS: St. Lucy Parish, Little Bay, no. 67-840 (on *Sphacelaria*).

ULVACEAE

ENTEROMORPHA Link, 1820

E. chaetomorphoides Børg. (?):– BARBADOS: St. Peter Parish, Six Mens Bay, no. 67-799.

E. clathrata (Roth) J. Agardh:– NEVIS: St. James Windward Parish, Mosquito Bay, no. 68-160. DOMINICA: St. Andrew Parish, Woodford Hill Bay, no. R-246. GRENADA: St. George Parish, Grand Mal Bay, no. 66-252.

E. plumosa Kütz.:– GRAND BAHAMA: West End near hotel, no. 68-11. GRAND CAYMAN: South Shore east of Boddentown near "Joe Conyers", no. 67-38A. ST. LUCIA: Castries Quarter, Grande Cul de Sac, no. 68-356.

E. lingulata J. Agardh:– GRAND CAYMAN: North Sound, Botabano, no. GRP-A.2499; South Shore, east of Boddentown at "Joe Conyers", no. 67-39. NEVIS: St. Thomas Lowland Parish, Pinneys Beach, no. 68-136. ANTIGUA: St. John Parish, Hodge Point, no. 67-260; St. Philip Parish, Exchange Bay, no. 66-461; St. Paul Parish, Crawle Bay, no. 67-209A. DOMINICA: St. Joseph Parish, north of St. Joseph, R. M. King no. C-1139; St. David Parish, Rosalie, no. 67-458. ST. LUCIA: Gros Islet Quarter, La Brellotte Bay, no. 68-291; Laborie Quarter, Laborie, no. 68-337. BARBADOS: St. Peter Parish, Bayfield, no. 66-27, Six Mens Bay, no. 67-650; St. Lucy Parish, River Bay, nos. 66-72, 68-458; St. John Parish, Bath Bay, no. 67-667; Christ Church Parish, St. Lawrence Bay, no. 68-505. ST. VINCENT: St. Patrick Parish, Barrouallie, no. 66-328B. BEQUIA: Adams Beach, no. 66-374. GRENADA: St. George Parish, True Blue, no. GRP-A.2699 *p.p.*

E. flexuosa (Wulf.) J. Agardh:– GRAND BAHAMA: West End near hotel, no. 68-5. ST. KITTS: St. George Basseterre Parish, Frigate Bay, no. 68-116. ANTIGUA: St. John Parish, St. John Harbor, no. 67-282, Deep Bay, no. 67-303B. MONTSERRAT: St.

[1] Serial numbers of material for which I was the senior collector are preceded by the last digits of the collection year (*e.g.*, 67-234). For the work on Dominica where C. F. Rhyne was the sole collector his initial precedes his collection number (R-234), and for some collected by William Stern and D. C. Wasshausen their initials appear (S & W-234). Material from several islands collected by G. F. Proctor is similarly indicated (GFP-A.234).

Peter Parish, Woodlands Bay, no. 67-309. DOMINICA: St. Joseph Parish, 400 m. south of Layou River, no. 67-338; St. John Parish, Prince Rupert Bay, no. 67-486, Douglas Bay, no. 67-500; St. David Parish, Rosalie, no. 67-457. BARBADOS: St. Michael Parish, Gravesend, no. 67-701, Carlisle Bay, no. 67-761; St. Peter Parish, Six Mens Bay, no. 67-641; St. Lucy Parish, River Bay, nos. 67-680, 68-450; St. John Parish, Martins Bay, no. 68-517; Christ Church Parish, Oistins, nos. 66-111, 67-614B. ST. VINCENT: St. George Parish, Calliaqua, no. GRP-A.5299. BEQUIA: Adams Beach, no. 66-389.

E. linza (L.) J. Agardh:– GRENADA: St. Andrew Parish, Grenville Beach, no. 66-302.

MONOSTROMA Thuret, 1854

M. oxyspermum (Kütz.) Doty:– GRAND BAHAMA: West End, Settlement Point, no. 68-20.

ULVA Linnaeus, 1753

U. lactuca L., var. **lactuca**, or near var. **rigida** (C. Agardh) Le Jolis:– GRAND CAYMAN: North Sound, Botabano, no. GRP-A.2496. ANTIGUA: St. John Parish, St. John Harbor, no. 67-281. DOMINICA: St. Andrew Parish, Calibishie, no. 67-531. BARBADOS: St. James Parish, Paynes Bay, no. 68-555; Christ Church Parish, Rockley Beach, no. 67-709, Hastings, no. 66-197. ST. VINCENT: St. George Parish, Calliaqua, no. GRP-A.5243.

————————, "var. **latissima**" Auct., *non* L.:– ANTIGUA: St. George Parish, St. George Bay, no. 66-496. (Cfr. Papenfuss 1960, p. 303).

U. fasciata Delile:– ST. KITTS: St. John Capisterre Parish, Dieppe Bay, no. 68-54; St. Peter Basseterre Parish, North Frigate Bay, no. 68-71. NEVIS: St. George Gingerland Parish, Indian Castle Estate, no. 68-233. ANTIGUA: St. John Parish, St. John Harbor, causeway to Rat Island, no. 67-273, Soldiers Bay, no. 67-153; St. Paul Parish, Crawle Bay, no. 67-218. DOMINICA: St. George Parish, Roseau, no. 67-348; St. Joseph Parish, south of the Macoucherie River, no. 67-396; St. John Parish, Prince Rupert Bay, no. 67-487; St. Mark Parish, Soufrière Bay, nos. 67-428, R-279. ST. LUCIA: Castries Quarter, Castries Harbor, no. 68-401; St. George Gingerland Quarter, Indian Castle Estate beach, no. 68-233. BARBADOS: St. Michael Parish, Carlisle Bay, no. 67-762, Bridgetown, off Pelican Village, no. 67-754; St. Lucy Parish, Fryer Well Point, no. 66-16; Christ Church Parish, Oistins, no. 67-624. ST. VINCENT: St. George Parish, Calliaqua, no. 66-345A. GRENADA: St. George Parish, Point Salines, Black Bay, no. 66-267.

CLADOPHORALES

CLADOPHORACEAE

CHAETOMORPHA Kützing, 1845

C. gracilis Kütz.:– ST. VINCENT: St. Patrick Parish, Barrouallie, no. 66-328A. BARBADOS: St. Lucy Parish, River Bay, no. 66-66A.

C. brachygona Harv.:– ANTIGUA: St. John Parish, Hodge Point, no. 67-239. ST. LUCIA: Castries Quarter, Grande Cul de Sac, no. 68-359. BARBADOS: St. Lucy Parish, River Bay, no. 67-681; Christ Church Parish, Rockley Beach, no. 67-708B. ST. VINCENT: St. George Parish, Calliaqua Bay, no. GRP-A.5307.

C. linum (Müll.) Kütz.:– ST. KITTS: St. George Basseterre Parish, Frigate Bay, no.

68-104; St. Peter Basseterre Parish, North Frigate Bay, no. 68-72. DOMINICA: St. Paul Parish, 1.2 km. south of the Layou River, no. 67-360; St. John Parish, Prince Rupert Bay, no. 67-488. ST. VINCENT: St. George Parish, Calliaqua, no. 66-341; St. Andrew Parish, Camden Beach, no. 66-337 (?). BEQUIA: Friendship Bay, no. 66-367.

C. geniculata Mont.:– ANTIGUA: St. John Parish, Hodge Point, no. 67-239(?).

C. nodosa Kütz.:– GRAND CAYMAN: South Shore, Red Bay, no. 67-110. ANTIGUA: St. John Parish, Goat Hill Bay, no. 67-303A, Loblolly Bay, no. 67-293A; St. Philip Parish, Fanneys Cove, no. 67-247(?). DOMINICA: St. George Parish, Roseau, no. 67-356; St. Paul Parish, 1.6-3.2 km. south of the Layou River, no. 67-328; St. Joseph Parish, north of St. Joseph, R. M. King no. C-1137, south of the Macoucherie River, no. 67-410; St. John Parish, Douglas Bay, no. 67-498; St. Andrew Parish, Woodford Hill Bay, no. R-247, Calibishie Bay, no. 67-553; St. Mark Parish, Soufrière Bay, no. 67-422. ST. LUCIA: Gros Islet Quarter, La Brellotte Bay, no. 68-277(?), Jacks Beach, no. 68-410.

The filament diameter of much of this material reaches 100 μ, and in no. 68-410 is still greater in the upper parts which, however, are probably reproductive. The basal cell is very slender at the discoid holdfast, and at the top 27-50 (-65) μ diam., the length very variable, but usually 3-4 times the maximum diameter, or 90-140 μ, much smaller than in *C. aerea.*

C. crassa (C. Agardh) Kütz.:– NEVIS: St. George Gingerland Parish, Indian Castle Estate beach, no. 68-234(?). ANTIGUA: St. Paul Parish, Crawle Bay no. 67-229. ST. LUCIA: Vieux Fort Quarter, Anse des Sables, no. 68-327. GRENADA: St. Andrew Parish, Grenville Beach, no. 66-304A.

Some of the collections are composed of filaments small for this species, such as nos. 68-234 and 68-337, which have a maximum filament diameter of about 430 μ, but the walls are thin and do not have the rigidity characteristic of *C. linum,* for which the size is, in addition, somewhat excessive.

C. aerea (Dillw.) Kütz.:– DOMINICA: St. John Parish, Douglas Bay at Tanetane, nos. 67-495, 67-499. ST. LUCIA: Gros Islet Quarter, Jacks Beach, no. 68-410.

C. media (C. Agardh) Kütz.:– ANTIGUA: St. John Parish, Hodge Bay, no. 67-264(?). NEVIS: St. Thomas Lowland Parish, Pinneys Beach, no. 68-134. DOMINICA: St. George Parish, Roseau, no. 67-353; St. Mark Parish, Soufrière Bay, nos. 67-423, R-264. BARBADOS: St. Michael Parish, Bridgetown at Pelican Village, no. 67-753; St. Peter Parish, Bayfield, no. 66-24, Heywoods Beach, no. 67-421, Six Mens Bay, no. 67-639; St. Lucy Parish, Little Bay, no. 67-839; Christ Church Parish, Oistins, nos. 66-122, 67-605, 68-417, Welches, no. 68-491.

C. clavata (C. Agardh) Kütz.:– DOMINICA: St. Joseph Parish, 400 m. south of the Layou River, no. 67-333. GRENADA: St. Andrew Parish, Marquis, no. 66-280B(?).

RHIZOCLONIUM Kützing, 1843

R. kerneri Stockm.:– BEQUIA: Adams Beach, no. 66-375.

CLADOPHORA Kützing, 1843

As in various other areas, in the Caribbean there are a few readily-recognized species of *Cladophora,* and others which are of quite uncertain status. Partly this is because names of European algae have been applied to our plants, which do not exactly conform in character to their supposed European types. Partly it is because

our species have never really been segregated, clearly typified and their range of variation established. It is a difficult genus, here as elsewhere. Because of the uncertainty attending their identification it has been decided to omit from the present report all but a few of the most distinct and best-known Caribbean species. Plants of large size are not common on these shores.

C. fuliginosa Kütz.:– GRAND CAYMAN: West Shore, near the West Indian Club, no. 67-25D, near Pageant Beach Hotel, no. 67-82; North Shore, Grape Tree Point, no. GRP-A.2492. NEVIS: St. James Windward Parish, Sea Haven Estate, no. 68-209. ANTIGUA: St. John Parish, Hodge Point, nos. 66-438A, 67-134. DOMINICA: St. Andrew Parish, Calibishie Bay, nos. R-173, R-182A, R-189C. ST. LUCIA: Gros Islet Quarter, La Brellotte Bay, no. 68-262.

C. fascicularis (Mert.) Kütz.:– ST. KITTS: St. George Basseterre Parish, Frigate Bay, no. 68-117. NEVIS: St. Thomas Lowland Parish, Pinneys Beach, no. 68-135; St. James Windward Parish, Mosquito Bay, no. 68-162. DOMINICA: St. Paul Parish, 1.2 km. south of the Layou River, no. 67-362; St. Joseph Parish, 400 m. south of the Layou River, no. 67-339; St. John Parish, Prince Rupert Bay, no. 67-473, Douglas Bay, no. 68-504; St. Andrew Parish, Woodford Hill Bay, no. R-215. ST. LUCIA: Castries Quarter, Grande Cul de Sac, no. 68-367; Vieux Fort Quarter, Anse des Sables, no. 68-338. BARBADOS: St. Michael Parish, Gravesend, no. 67-705, Carlisle Bay, no. 67-759; St. Lucy Parish, River Bay, nos. 67-820, 68-448; Christ Church Parish, Oistins, nos. 66-99, 67-737A, St. Lawrence Bay, no. 68-504. ST. VINCENT: St. George Parish, Calliaqua Bay, no. GRP-5308; St. Andrew Parish, Camden Beach, no. 66-336. BEQUIA: Adams Beach, no. 66-398B. GRENADA: St. George Parish, Point Salines, Black Bay, no. 66-269; St. Andrew Parish, Grenville Beach, no. 66-301.

C. prolifera (Roth) Kütz.:– BARBADOS: St. Lucy Parish, Little Bay, no. 67-836; Christ Church Parish, Oistins, nos. 67-602, 68-416.

SIPHONOCLADIALES

DASYCLADACEAE

DASYCLADUS C. Agardh, 1827

D. vermicularis (Scop.) Kras.:– GRAND BAHAMA: West End, no. 68-30. GRAND CAYMAN: North Shore, Grape Tree Point, no. GRP-A.2491.

NEOMERIS Lamouroux, 1816

N. cokeri Howe:– GRAND BAHAMA: West End, no. 68-29.

N. mucosa Howe:– ANTIGUA: St. Paul Parish, Crawle Bay, no. 67-215; St. John Parish, Hodge Point, no. 67-240.

N. annulata Dickie:– ANTIGUA: St. John Parish, Wetherell Point, no. 66-470A. DOMINICA: St. Andrew Parish, Calibishie Bay, no. R-198. BARBADOS: St. Michael Parish, Gravesend, no. 67-774, 68-510; St. John Parish, Bath Bay, no. 66-169.

N. dumetosa Lamx.:– DOMINICA: St. Joseph Parish, 400 m. south of the Layou River, no. 67-334.

CYMOPOLIA Lamouroux, 1816

C. barbata (L.) Lamx.:– ANTIGUA: St. John Parish, off Wetherell Point, no. 66-402.

ACETABULARIA Lamouroux, 1816

A. pusilla (Howe) Collins:– ANTIGUA: St. Philip Parish, Fanneys Cove, no. 67-256.

A. crenulata Lamx.:– GRAND CAYMAN: West Shore near West Indian Club, no. 67-25A; South Shore, Red Bay, no. 67-66.

ACICULARIA D'Archiac, 1843

A. schenckii (Möb.) Solms-Laub.:– BARBADOS: St. Andrew Parish, near Windy Hill, no. 67-225.

VALONIACEAE

HALICYSTIS Areschoug, 1850

H. osterhoutii L. R. & A. H. Blinks:– GRAND CAYMAN: East End, Gun Bay, no. 67-59B.

VALONIA Ginnani, 1757

V. ventricosa J. Agardh:– GRAND CAYMAN: West Shore near West Indian Club, no. 67-25C, Red Bay, no. 67-75B. ST. KITTS: St. Peter Basseterre Parish, North Frigate Bay, no. 68-102. NEVIS: St. Thomas Lowland, Pinneys Beach, no. 68-122A; St. James Windward Parish, Mosquito Bay, no. 68-188, Sea Haven Estate, no. 68-214. ANTIGUA: St. John Parish, Port Royal Bay, no. 67-155, Hodge Point, no. 66-407; St. George Parish, Judge Bay, no. 67-199. ST. LUCIA: Gros Islet Quarter, La Brellotte Bay, no. 68-298. BARBADOS: St. James Parish, off Coral Reef Club area near Holetown, at 7.5 m. depth, the largest specimen being a simple obovoid, 60 mm. long, 47 mm. in max. diam., no. 67-862; St. John Parish, Bath Bay, nos. 66-147, 67-671, Conset Bay, no. 68-538; Christ Church Parish, Oistins, Nos. 66-114B, 67-737B. ST. VINCENT: St. George Parish, Calliaqua, no. GRP-A.5285. BEQUIA: Friendship Beach, no. 66-364. GRENADA: St. Andrew Parish, Marquis, no. 66-274.

V. macrophysa Kütz.:– GRAND CAYMAN: North Shore, Grape Tree Point, no. GRP-A.2486; South Shore, Red Bay, no. 67-75A. NEVIS: St. George Gingerland Parish, Indian Castle Estate, no. 68-235. ANTIGUA: St. George Parish, Judge Bay, no. 67-188. BARBADOS: St. James Parish, off Miramar Hotel near Holetown at 60-70 m. depth, no. 66-140. ST. VINCENT: St. George Parish, Calliaqua, no. GRP-A.5285. BEQUIA: Friendship Beach, no. 66-365.

V. ocellata Howe:– GRAND CAYMAN: South Shore, Red Bay, no. 67-74, Boddentown, no. 67-51. BARBADOS: St. John Parish, Martins Bay, no. 68-523.

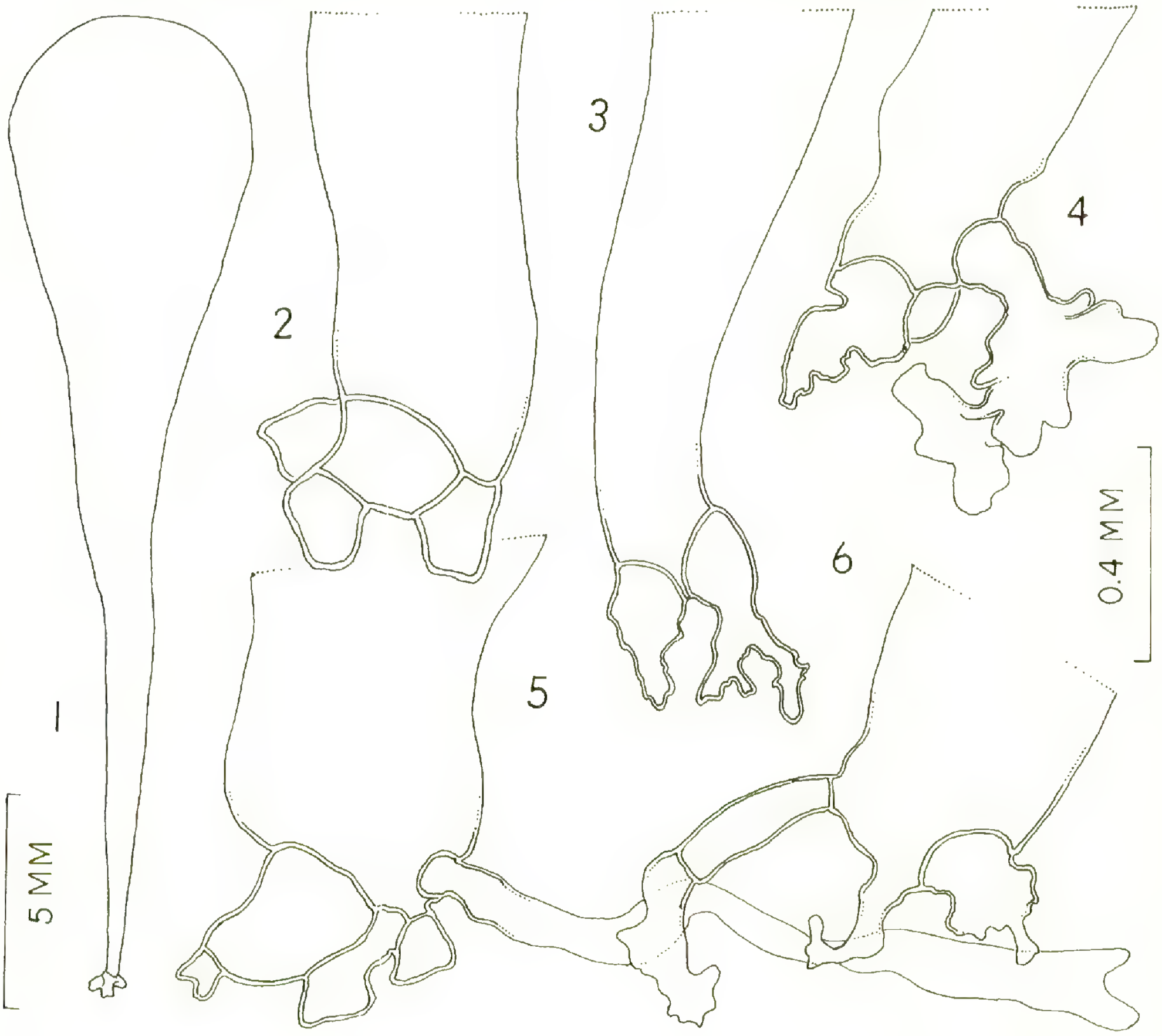
V. aegagropila C. Agardh:– NEVIS: St. James Windward Parish, Sea Haven Estate, no. 68-198.

V. barbadensis n. sp.:– Plantae clavatae, ad 1.5-2.5 cm. alt., coenocytia principalia ad basim teniussima, distaliter ad 2-5 mm. diam., in 1-3 cellulis hapteralibus parvis, simplicibus aut sublobatis, innata, hae cellulae plerumque breves interdum, autem, in filamenta 1.0-1.5 mm. long., quae membranam tenuem habent, evolventes. Membrana coenocytiorum principalium tenuissima, prope basim, autem, et in hapteris satis crassior. Reproductio per numerosas sporas cystiformes (35)-45-90-(125) μ diam. effecta, membranis 2.0-3.5 μ crass. Planta typica e loco I. Barbados, Paroecia St. John, Bath dicto; plantae in petris corallinis paululum infra aquae altitudinem aestus recessu abunde sparsae, W. R. Taylor cum M. Goldstein et

D. Patriquin lectae, no. 66-168. Planta typica in Herbario Universitatis Michiganensis deposita.

Plants delicate, clavate, to 1.5-2.5 cm. tall, the main coenocytes exceedingly slender at the base, to 2-5 mm. diam. distally, borne on 1-3 (or more?) small, simple or somewhat lobed hapteral cells which are usually short, but may develop into thin-walled filaments 1.0-1.5 mm. long; cell wall of the main coenocytes for the most part very thin, but near the base and in the haptera somewhat thicker. Reproduction by very numerous cyst-like spores (35)-45-90-(125) μ diam., with smooth walls 2.0-3.5 μ thick. BARBADOS: St. John Parish, Bath, the plants scattered in some abundance on coral rock somewhat below low tide level. Coll. by W. R. Taylor, M. Goldstein and D. Patriquin, no. 66-168.

One would be satisfied to call this a *Valonia* were it not for the cyst-like spores, which are not a form of reproduction to be expected in that group. However, as the function of these is not known it seems best to associate these plants tentatively with that genus until more is known about them. Text-figures 1-6.



Text-figures 1–6. *Valonia barbadensis.* Fig. 1, entire plant with a 5 mm. scale bar. Figs. 2–6, basal portions of 5 plants showing hapteral cells and filamentous outgrowths, with 0.4 mm. bar. Barbados.

ERNODESMIS Børgesen, 1912

E. verticillata (Kütz.) Børg.:– GRAND BAHAMA: West End, near hotel, no. 68-21.

ANTIGUA: St. Paul Parish, Crawle Bay, no. 67-212. DOMINICA: St. Andrew Parish, Calibishie Bay, no. 67-526, 67-564. ST. LUCIA: Castries Quarter, Grande Cul de Sac, no. 68-358. BARBADOS: St. John Parish, Bath Bay, no. 67-666, Conset Bay, no. 66-214; Christ Church Parish, Silver Sands, no. 66-128, Oistins, no. 66-100, St. Lawrence Bay, no. 66-195. ST. VINCENT: Calliaqua, no. GRP-A.5275.

SIPHONOCLADUS Schmitz, 1878

A. tropicus (Crouan) J. Agardh:— NEVIS: St. James Windward Parish, Mosquito Bay, no. 68-164, Sea Haven Estate, no. 68-210; St. George Gingerland Parish, Indian Castle Estate, no. 68-247. DOMINICA: St. Andrew Parish, Calibishie Bay, nos. 67-562, R-176. ST. LUCIA: Castries Quarter, Grande Cul de Sac, no. 68-357. BARBADOS: St. John Parish, Conset Bay, no. 66-212; Christ Church Parish, Oistins, no. 67-735. GRENADA: St. Andrew Parish, Marquis, no. 66-280A.

CHAMAEDORIS Montagne, 1862

C. peniculum (Soland).[1] Kuntze:— NEVIS: St. James Windward Parish, Mosquito Bay, no. 68-165; Sea Haven Estate, no. 68-197. DOMINICA: St. Andrew Parish, Calibishie Bay, no. 67-538; St. Mark Parish, Atlantic side of Scotts Head, no. R-291. ST. LUCIA: Dauphin Quarter, Grande Anse, no. 68-288. BARBADOS: St. Lucy Parish, River Bay, nos. 66-69, 67-810; St. Andrew Parish, Chalky Mount, no. 68-480, where very abundant in some deep tide-pools; St. John Parish, Bath Bay, nos. 66-162, 67-662; Christ Church Parish, Oistins, no. 67-733.

DICTYOSPHAERIA Decaisne, 1842

D. vanbosseae Børg.:— ST. KITTS: St. Peter Basseterre Parish, North Frigate Bay, no. 68-84. ANTIGUA: St. John Parish, Hodge Point, no. 66-409. DOMINICA: St. Andrew Parish, Calibishie Bay, no. 67-554. ST. LUCIA: Gros Islet Quarter, La Brellotte Bay, no. 68-305. BARBADOS: St. James Parish, Paynes Bay, no. 66-33; St. Lucy Parish, River Bay, no. 67-819, Little Bay, nos. 66-54, 67-845; St. John Parish, Martins Bay, no. 68-552; Christ Church Parish, Oistins, no. 66-120. (However, see Valet 1966, p. 256)

D. cavernosa (Forssk.) Børg.:— GRAND CAYMAN: West Shore near West Indian Club, no. 67-25B; North Shore, Grape Tree Point, no. GRP-A.2478; South Shore, Red Bay, no. 67-114. NEVIS: St. Thomas Lowland Parish, Pinneys Beach, no. 68-121B; St. James Windward Parish, Mosquito Bay, no. 68-189, Sea Haven Estate, no. 68-213. ANTIGUA: St. John Parish, Hodge Point, no. 66-419A; St. George Parish, Judge Bay, no. 67-193. DOMINICA: St. Andrew Parish, Calibishie Bay, nos. R-195, R-199. ST. LUCIA: Vieux Fort Quarter, Anse des Sables, no. 68-334. BARBADOS: St. John Parish, Martins Bay, no. 68-521, Bath Bay, nos. 66-173, 67-859; Christ Church Parish, Silver Sands, no. 66-125. BEQUIA: Friendship Beach, no. 66-363. GRENADA: St. Andrew Parish, Marquis Beach, no. 66-275.

[1] In my general text on tropical algae (1960) and elsewhere I have often cited J. Ellis and D. Solander as joint authors of various species names. As early publications of Ellis (1755, 1756) use a pre-Linnean terminology they are not available as sources. While his 1767 paper is in approximate conformity with the current International Rules, most of the names concerned come from D. Solander (1787) posthumously. As the title-page of this work clearly designates Ellis as the collector, Solander as describer, Solander should be cited as sole author. This has long been recognized by some phycologists, as Kjellman (1900), but not by Hauck (1885), Collins (1909b), Børgesen (1911b) or Howe (1918a), while J. G. Agardh (1876) cites many as Solander *in* Ellis, which hardly seems defensible.

PETROSIPHON Howe, 1905

P. adhaerens Howe:– GRAND CAYMAN: West Shore near West Bay village between Northwest Point and Boatswains Bay, no. 67-99. Also seen, but not collected, near Savannah on the north coast. Unless one is equipped with rock-breaking tools it is very difficult to collect this plant. It has seldom been reported.

CLADOPHOROPSIS Børgesen, 1905

C. membranacea (C. Agardh) Børg.:– GRAND CAYMAN: South Shore, Red Bay, no. 67-77, east of Boddentown near "Joe Conyers", no. 67-37; East End at Gun Bay, no. 67-59A. ST. KITTS: St. George Basseterre Parish, Frigate Bay, no. 68-100. NEVIS: St. James Windward Parish, Mosquito Bay, no. 68-187. ANTIGUA: St. John Parish, Hodge Point, no. 67-438C, Wetherell Point, no. 67-479. DOMINICA: St. John Parish, Prince Rupert Bay, no. 67-483; St. Andrew Parish, Calibishie Bay, nos. 67-559, R-173A; St. Mark Parish, Soufrière Bay, nos. 67-425, R-266. ST. LUCIA: Castries Quarter, La Toc, no. 68-408; Vieux Fort Quarter, Anse des Sables, no. 68-326. BARBADOS: St. James Parish, Paynes Bay, no. 68-561; St. Peter Parish, Heywood Beach, no. 68-424, Six Mens Bay, nos. 66-21B, 67-648; St. Lucy Parish, River Bay, nos. 67-683, 68-453; St. Joseph Parish, Cattle Wash, no. 66-2; St. John Parish, Bath, no. 66-170; Christ Church Parish, Oistins, no. 67-634. ST. VINCENT: St. George Parish, Calliaqua Bay, no. GRP-A.5252. BEQUIA: Adams Beach, no. 66-379B.

C. macromeres W. R. Taylor:– BARBADOS: Christ Church Parish, Oistins, no. 67-634.

BOODLEA Murray & DeToni, 1890

B. composita (Harv.) Brand:– ANTIGUA: St. John Parish, St. John Harbor, no. 67-368(?). ST. LUCIA: Gros Islet Quarter, LaBrellotte Bay, no. 68-268. DOMINICA: St. Mark Parish, Soufrière Bay, no. 67-426, R-268.

MICRODICTYON Decaisne, 1839

M. boergesenii Setch.:– BARBADOS: St. James Parish, off Miramar Hotel near Holetown at 60-70 m. depth, no. 66-139.

STRUVEA Sonder, 1845

S. anastomosans (Harv.) Picc.:– DOMINICA: St. John Parish, Douglas Bay, no. 67-492; St. Andrew Parish, Calibishie, no. R-170; St. Mark Parish, Soufrière Bay, no. 67-434.

ANADYOMENE Lamouroux, 1812

A. stellata (Wulf.) C. Agardh:– NEVIS: St. James Windward Parish, Sea Haven Estate, no. 68-196. ANTIGUA: St. John Parish, Hodge Point, no. 67-143; St. George Parish, Judge Bay, no. 67-198. DOMINICA: St. Andrew Parish, Woodford Hill Bay, no. R-214, Calibishie Bay, no. 67-580. ST. LUCIA: Gros Islet Quarter, La Brellotte Bay, no. 68-303. BARBADOS: St. Lucy Parish, River Bay, no. 67-816, Little Bay, no. 66-53; St. John Parish, Bath Bay, no. 66-161, Conset Bay, no. 66-219.

SIPHONALES

BRYOPSIDACEAE

BRYOPSIS Lamouroux, 1809

B. plumosa (Huds.) C. Agardh:— ANTIGUA: St. John Parish, lagoon behind Pinchin Bay, no. 67-285; St. Philip Parish, Fanneys Cove, no. 67-246. GRENADA: St. George Parish, Point Salines, Black Bay, no. 66-268.

B. pennata Lamx.:— ANTIGUA: St. Paul Parish, Crawle Bay, no. 67-210; BARBADOS: St. Michael Parish, Bridgetown at Pelican Village, no. 67-752; St. James Parish, Paynes Bay, no. 66-36; St. Peter Parish, Six Mens Bay, no. 67-801; St. Lucy Parish, River Bay, no. 67-822, Little Bay, no. 67-838; Christ Church Parish, Hastings, 66-203.

B. halliae W. R. Taylor:— GRAND CAYMAN: North Sound, Georgetown Embarcadero, no. 67-122.

CAULERPACEAE

CAULERPA Lamouroux, 1809

C. fastigiata Mont.:— GRAND CAYMAN: South Shore, Red Bay, no. 67-68C. BARBADOS: Christ Church Parish, Oistins, no. 67-606.

C. vickersiae Børg.:— ANTIGUA: St. John Parish, Hodge Point, no. 67-238. ST. LUCIA: Gros Islet Quarter, La Brellotte Bay, no. 68-315 (*p.p.*, with *Dasya*).

C. verticillata J. Agardh:— GRAND CAYMAN: North Sound, Botabano, no. GRP-A.2498.

C. webbiana Mont.:— ST. KITTS: St. Peter Basseterre Parish, North Frigate Bay, no. 68-74.

C. ashmeadii Harv.:— NEVIS: St. James Windward Parish, Sea Haven Estate, no. 68-206A.

C. cupressoides (West) C. Agardh, var. **cupressoides**:— GRAND CAYMAN: West Shore near West Indian Club, no. 67-21. NEVIS: St. Thomas Lowland Parish, Pinneys Beach, no. 68-139; St. James Windward Parish, Mosquito Bay, no. 68-179, Sea Haven Estate, no. 68-218C (all 3 near v. *flabellata*). ANTIGUA: St. John Parish, Hodge Point, no. 66-425 (near v. *mamillosa*); St. George Parish, Judge Bay, no. 67-206 (near v. *serrata*); St. Paul Parish, Crawle Bay, no. 67-231 (near v. *ericifolia*). DOMINICA: St. Andrew Parish, Calibishie Bay, nos. R-154, R-185. BARBADOS: St. John Parish, Bath Bay, no. 67-856 (near v. *turneri*); St. Andrew Parish, Chalky Mount, nos. 67-851, 68-479 (near v. *mamillosa*).

————————, var. **lycopodium** (West) C. Agardh:— GRAND CAYMAN: West Shore, West Bay near Pageant Beach Hotel, no. 67-117. ST. LUCIA: Gros Islet Parish, La Brellotte Bay, no. 68-313A. BARBADOS: St. Michael Parish, Gravesend, no. 67-769, Garrison, no. 68-511; St. James Parish, Heronetta Beach, no. 68-551; St. Andrew Parish, Chalky Mount, no. 68-484; St. John Parish, Bath Bay, no. 66-152. ST. VINCENT: St. George Parish, Calliaqua Bay, no. GRP-A.5300.

————————, ————————, forma **elegans** (Crouan) Weber-van Bosse:— ANTIGUA: St. Paul Parish, Crawle Bay, no. 67-213. DOMINICA: St. Joseph Parish, 185 m. and 400 m. south of the Layou River, nos. R-318, 67-227 (intermediate to f. *disticha*). BARBADOS: St. John Parish, Conset Bay, no. 66-213.

————————, var. **mamillosa** (Mont.) Weber-van Bosse:— ANTIGUA: St. John Parish, Hodge Point, no. 66-425. ST. LUCIA: Gros Islet Quarter, La Brellotte Bay, no. 68-313B. BARBADOS: St. Lucy Parish, River Bay, no. 68-447. ST. VINCENT: St. George Parish, Calliaqua, no. GRP-A.5242. BEQUIA: Adams Beach, no. 66-376.

———— ———, var. **serrata** (Kütz.) Weber-van Bosse:— BARBADOS: St. Michael Parish, Gravesend, no. 68-512.

C. **mexicana** (Sond.) J. Agardh:— ANTIGUA: St. George Parish, Judge Bay, no. 67-203. BARBADOS: St. Andrew Parish, Chalky Mount, no. 68-473. GRENADA: St. Andrew Parish, Grenville Beach, no. 66-304B.

C. **prolifera** (Forssk.) Lamx.:— ST. KITTS: St. Peter Basseterre Parish, North Frigate Bay, no. 68-76. NEVIS: St. Thomas Lowland Parish, Pinneys Beach, no. 68-127, Jones Bay, no. 68-153. ANTIGUA: St. John Parish, Hodge Point, no. 66-426; St. George Parish, Judge Bay, no. 67-200.

C. **scapelliformis** (R. Br.) C. Agardh:— ANTIGUA: St. John Parish, St. John Harbor, rocks along causeway to Rat Island, no. 67-268. BARBADOS: St. Michael Parish, Garrison, no. 68-513, Carlisle Bay, no. 67-756; St. James Parish, Coral Reef Club near Holetown, no. 67-695; St. John Parish, Bath Bay, nos. 66-153, 66-191, Conset Bay, no. 66-210; Christ Church Parish, Oistins, nos. 66-117A, 67-632, 68-415, Welches, no. 68-490, Maxwell Coast, no. 66-233, St. Lawrence Bay, nos. 67-719, 68-503.

As found in the West Indies this plant grows in the lowest intertidal zone where there is only very moderate wave action, and in the lower tide pools, but more luxuriantly in very quiet water, such as along the Rat Island causeway in St. John Harbor, where it was abundant just below lowest spring tides. Major construction looking toward a deep water harbor in progress in 1968 may have destroyed this station, but the plant is probably well established elsewhere along the shores nearby.

C. **sertularioides** (Gmel.) Howe, var. **sertularioides**:— GRAND CAYMAN: South Shore, Red Bay, no. 67-67. NEVIS: St. James Windward Parish, Mosquito Bay, no. 68-176, Sea Haven Estate, no. 68-207A. ANTIGUA: St. John Parish, St. John Harbor, no. 67-276, Hodge Point, no. 66-443; St. George Parish, Judge Bay, no. 67-202. DOMINICA: St. Paul Parish, 1.2 km. south of the Layou River, no. 67-363; St. Joseph Parish, 185 m. and 400 m. south of the Layou River, nos. R-319, 67-463. ST. LUCIA: Gros Islet Quarter, La Brellotte Bay, no. 68-286; Laborie Quarter, Laborie, no. 68-341. BARBADOS: St. Michael Parish, Gravesend, no. 67-770; St. James Parish, Heronetta Beach, no. 68-552; off the Coral Reef Club area near Holetown at 2.5 m. depth, no. 68-747; St. Lucy Parish, Little Bay, no. 66-52; St. Andrew Parish, Chalky Mount, no. 68-483. BEQUIA: Adams Beach, no. 66-385.

————, ————, forma **brevipes** (Gmel.) Howe:— ST. KITTS: St. George Basseterre Parish, Frigate Bay, no. 68-101. DOMINICA: St. Andrew Parish, Calibishie Bay, no. R-186. ANTIGUA: St. John Parish, Goat Hill Bay, no. 67-302, Hodge Point, no. 66-429. BARBADOS: St. James Parish, Coral Reef Club area near Holetown, no. 67-747; St. John Parish, Martins Bay, no. 68-518. ST. VINCENT: St. George Parish, Calliaqua Bay, no. GRP-A.5244.

C. **taxifolia** (Vahl) C. Agardh:— ST. KITTS: St. Peter Parish, North Frigate Bay, no. 68-81. NEVIS: St. Thomas Lowland Parish, Pinneys Beach, no. 68-128, Jones Bay, no. 68-154. ANTIGUA: St. John Parish, St. John Harbor, causeway to Rat Island, no. 67-270; St. George Parish, Judge Bay, no. 67-204. DOMINICA: St. Andrew Parish, Calibishie Bay, no. 67-540. ST. LUCIA: Castries Quarter, Grande Cul de Sac, no. 68-362. BARBADOS: St. John Parish, Conset Bay, no. 66-215. GRENADA: St. Patrick Parish, Levera Beach, no. 66-286.

C. **racemosa** (Forssk.) J. Agardh:— GRAND CAYMAN: North Sound, Botabano, no.

GRP-A.2500; East End, Old Isaacs, no. GRP-A.2467; South Shore, east of Boddentown near "Joe Conyers", no. 67-36. ST. KITTS: St. Peter Basseterre Parish, North Frigate Bay, no. 68-90. ANTIGUA: St. John Parish, Goat Hill Bay, no. 67-305, Wetherell Point, no. 66-480, Hodge Point, nos. 66-447, 67-261; St. Paul Parish, Crawle Bay, no. 67-211. DOMINICA: St. Andrew Parish, Calibishie Bay, no. 67-534. ST. LUCIA: Laborie Parish, Laborie, no. 68-342. BARBADOS: St. Michael Parish, Gravesend, no. 67-771; St. Peter Parish, Heywoods Beach, no. 68-431, Six Mens Bay, no. 67-795; St. Lucy Parish, Little Bay, nos. 66-51, 67-847, 68-441; St. Andrew Parish, Chalky Mount, nos. 66-224, 68-481; St. John Parish, Martins Bay, no. 68-519, Conset Bay, no. 66-216. ST. VINCENT: St. George Parish, Calliaqua Bay, nos. GRP-A.5241, A.5289. BEQUIA: Friendship Beach, no. 66-362.

C. microphysa (Weber-van Bosse) Feldmann:– NEVIS: St. James Windward Parish, Sea Haven Estate, no. 68-205. BARBADOS: St. Lucy Parish, Little Bay, no. 66-59. BEQUIA: Friendship Bay, no. 66-361.

CODIACEAE

AVRAINVILLEA Decaisne, 1842

A. rawsonii (Dickie) Howe:– GRAND CAYMAN: South Shore, Boddentown, no. 67-63; East End, Gun Bay, no. 67-53. ST. KITTS: St. Peter Basseterre Parish, North Frigate Bay, no. 68-88. ANTIGUA: St. John Parish, Hodge Point, no. 66-432B. ST. LUCIA: Gros Islet Parish, La Brellotte Bay, no. 68-320. BARBADOS: St. Michael Parish, Gravesend, no. 67-782; St. Lucy Parish, River Bay, no. 66-91, Little Bay, nos. 66-56, 68-443; St. Andrew Parish, Chalky Mount, nos. 67-852, 68-471; St. John Parish, Martins Bay, no. 68-516, Bath Bay, nos. 66-166, 67-665.

A. longicaulis (Kütz.) Murr. & Bood.:– GRAND CAYMAN: South Shore, Boddentown, no. 67-70. ANTIGUA: St. John Parish, Port Royal Bay, no. 66-485.

A. nigricans Decne., var. **nigricans**:– ANTIGUA: St. John Parish, Hodge Point, no. 67-244; St. George Parish, Judge Bay, no. 67-179. ST. LUCIA: Laborie Parish, Laborie, no. 68-343. BARBADOS: St. Andrew Parish, Chalky Mount, nos. 67-849, 68-472; St. John Parish, Bath Bay, no. 66-179A.

————, ————, forma **fulva** Howe:– GRAND CAYMAN: North Shore, Grape Tree Point, no. GRP-A.2753; South Shore, Red Bay, no. 67-71. BARBADOS: St. John Parish, Bath Bay, no. 68-179B.

A. asarifolia Børg.:– ST. LUCIA: Gros Islet Parish, La Brellotte Bay, no. 68-284B. BARBADOS: St. John Parish, Bath Bay, no. 68-531.

A. levis Howe:– GRAND CAYMAN: South Shore, Red Bay, no. 67-109. ST. LUCIA: Castries Quarter, Grande Cul de Sac, no. 68-365.

RHIPILIA Kützing, 1858

R. tomentosa Kütz.:– ANTIGUA: St. John Parish, Hodge Point, no. 66-430; St. George Parish, Judge Bay, no. 67-178.

UDOTEA Lamouroux, 1812

U. conglutinata (Soland.) Lamx.:– ANTIGUA: St. John Parish, Hodge Point, no. 66-431.

U. cyathiformis Decne.:– BARBADOS: St. John Parish, Bath Bay, quite numerous offshore at about 15 dm. depth at low tide, nos. 66-182, 67-854A; Christ Church Parish, Silver Sands, no. 66-130. ST. VINCENT: St. George Parish, Calliaqua, no. GRP-A.5273.

U. spinulosa Howe:– JAMAICA: St. Catherine Parish, dredged from 20 m. depth off Hellshire Hills, no. 56-281A; Portland Parish, San San, T. Goreau & J. Lang no. A.3354 *p.p.*

U. wilsonii Gepp & Howe: – JAMAICA: St. Andrew Parish, South Cay, T. Goreau & E. Graham nos. A.3446, A.3449, Southeast Cay, T. Goreau no. A.3455.

U. flabellum (Soland.) Lamx.:– GRAND CAYMAN: East End, Old Isaacs, no. GRP-A.2744. ST. KITTS: St. Peter Basseterre Parish, North Frigate Bay, no. 68-83. ANTIGUA: St. George Parish, Judge Bay, nos. 66-466, 67-201, St. George Bay, no. 66-498; St. Philip Parish, Exchange Bay, no. 66-463; St. Paul Parish, Crawle Bay, no. 67-232. DOMINICA: St. Andrew Parish, Woodford Hill Bay, Pointe La Soie, no. R-218, Calibishie, no. R-150. ST. LUCIA: Castries Quarter, Grande Cul de Sac, no. 68-368; Gros Islet Quarter, La Brellotte Bay, no. 68-390. BARBADOS: St. John Parish, Bath Bay, no. 66-181. ST. VINCENT: St. George Parish, Calliaqua, no. GRP-A.5234.

U. occidentalis A. & E. S. Gepp:– BERMUDA: without station, Sue Dimock, June 1891.

PENICILLUS Lamarck, 1813

P. capitatus Lamk.:– GRAND CAYMAN: North Shore, Grape Tree Point, no. GRP-A.2755; South Shore, east of Boddentown at "Joe Conyers", no. 67-42, Red Bay, no. 67-72A. ST. KITTS: St. Peter Basseterre Parish, North Frigate Bay, no. 68-87A. ANTIGUA: St. John Parish, Hodge Point, no. 66-442. DOMINICA: St. Andrew Parish, Calibishie, nos. R-151, R-174.

P. dumetosus (Lamx.) Blainv.:– GRAND CAYMAN: North Shore, Grape Tree Point, no. GRP-A.2752. ST. KITTS: St. Peter Basseterre Parish, North Frigate Bay, no. 68-87B. ANTIGUA: St. John Parish, Port Royal Bay, no. 66-486. GRENADA: St. Patrick Parish, Levera Beach, no. 66-290.

P. lamourouxii Decne.:– GRAND CAYMAN: South Shore east of Boddentown near "Joe Conyers", no. 67-33.

RHIPOCEPHALUS Kützing, 1843

R. phoenix (Soland.) Kütz.:– GRAND BAHAMA: West End near hotel, no. 68-13. ANTIGUA: St. John Parish, Port Royal Bay, no. 66-494.

HALIMEDA Lamouroux, 1812

H. opuntia (L.) Lamx.:– GRAND BAHAMA: West End near hotel, no. 68-15. GRAND CAYMAN: North Sound, Botabano, no. GRP-A.2513; East End, Old Isaacs, no. GRP-A.2749; South Shore, Red Bay, no. 67-113, Boddentown, no. 67-64. ST. KITTS: St. George Basseterre Parish, Frigate Bay, no. 68-105. NEVIS: St. James Windward Parish, Sea Haven Estate, no. 68-222. ANTIGUA: St. John Parish, Hodge Point, no. 66-436; St. Philip Parish, Exchange Bay, no. 66-464. ST. LUCIA: Castries Quarter, Grande Cul de Sac, no. 68-377; Gros Islet Quarter, La Brellotte Bay, no. 68-293; Laborie Quarter, Laborie, no. 68-350. BARBADOS: St. John Parish, Martins Bay, no. 68-520, Bath Bay, nos. 66-176, 67-660; Christ Church Parish, Hastings, no. 66-208. ST. VINCENT: St. George Parish, Calliaqua, no. GRP-A.5236. BEQUIA: Adams Beach, no. 66-377.

H. tuna (Soland.) Lamx.:– ST. KITTS: St. Peter Basseterre Parish, North Frigate Bay, no. 68-85. NEVIS: St. James Windward Parish, Sea Haven Estate, no. 68-223A.

H. discoidea Decne.:– ANTIGUA: St. John Parish, Wetherell Point, nos. 66-475, 67-262,

Hodge Point, no. 67-243. ST. LUCIA: Gros Islet Quarter, La Brellotte Bay, no. 68-391.

H. simulans Howe:– DOMINICA: St. John Parish, Prince Rupert Bay at 11-28 m. depth, W. L. Schmitt 28 Mar. 1956. ST. VINCENT: St. George Parish, Calliaqua, no. GRP-A.5282.

H. incrassata (Ell.) Lamx.:– GRAND CAYMAN: North Shore, Grape Tree Point, no. GRP-A.2526; South Shore, Red Bay, no. 67-73.

H. monile (Soland.) Lamx.:– GRAND CAYMAN: South Shore near Boddentown, no. 67-40. ANTIGUA: St. John Parish, Hodge Point, nos. 66-450, 67-245.

CODIUM Stackhouse, 1797

C. intertextum Coll. & Herv.:– BARBADOS: St. Michael Parish, Gravesend, no. 67-773; St. Andrew Parish, Chalky Mount, nos. 67-850, 68-470; St. John Parish, Bath Bay, no. 66-184.

C. isthmocladum Vickers:– NEVIS: St. Thomas Lowland Parish, Pinneys Beach, no. 68-143; St. James Windward Parish, Mosquito Bay, no. 68-161. DOMINICA: St. Paul Parish, 1.2 km. south of the Layou River, no. 67-364; St. Andrew Parish, Calibishie Bay, no. 67-532. ST. LUCIA: Castries Quarter, Grande Cul de Sac, no. 68-360A; Gros Islet Quarter, La Brellotte Bay, no. 68-395, Gros Islet Beach, no. 68-404. BARBADOS: St. Michael Parish, Gravesend, no. 67-772B, Carlisle Bay, no. 67-760; Christ Church Parish, Oistins, nos. 66-95, 67-635, St. Lawrence Bay, no. 66-186. ST. VINCENT: St. Andrew Parish, Camden Beach, no. 66-339. GRENADA: St. George Parish, Grand Anse Beach, no. 66-314.

C. repens Crouan *in* Vickers:– BARBADOS: St. John Parish, Bath Bay, no. 66-167, Conset Bay, no. 68-536.

C. taylori Silva:– ST. KITTS: St. John Capisterre Parish, Dieppe Bay, no. 68-69(?). ST. LUCIA: Castries Quarter, Grande Cul de Sac, no. 68-360B. BARBADOS: St. Michael Parish, Gravesend, no. 67-772A; Christ Church Parish, Oistins, no. 66-96. ST. VINCENT: St. Patrick Parish, Barrouallie, no. 66-326B. BEQUIA: Friendship Bay, no. 66-358.

CRYPTOPHYCEAE

Order and Family Uncertain

CHRYSOPHAEUM Lewis & Bryan, 1941

C. taylori Lewis & Bryan: - BERMUDA: St. Georges Parish, Nonsuch I., on the south side, no. 56-833; Hamilton I., Hamilton Parish, Walsingham Bay, no. 56-704. BAHAMAS: North Bimini I., on *Thalassia* flats near the Lerner Marine Laboratory, coll. Taylor 1964. GRAND CAYMAN I.: West Shore near Paget Beach Hotel, no. 67-115; South Shore east of Boddentown near "Joe Conyers", no. 67-29.

CHRYSOPHYCEAE

PHAEOTHAMNIACEAE

CHRYSONEPHOS Taylor, 1952

C. lewisii (Taylor) Taylor:– BERMUDA: St. Georges I., Richardsons Cove, A. J. Bernatowicz no. 50-517; Hamilton I., Pembroke Parish, Fairylands Creek, Bernatowicz no. 51-857. JAMAICA: St. Andrew Parish, Port Royal, on rocks, no. 56-33B, Palisadoes, on *Acanthophora,* no. 56-69. PUERTO RICO: Mayagüez Prov., Parguera, Lajas, in a fish trap, L. R. Almodóvar & V. M. Rosado no. 4826 (det. J. Th. Koster).

PHAEOPHYCEAE

ECTOCARPALES

ECTOCARPACEAE

BACHELOTIA (Bornet) Kuckuck, 1939

B. fulvescens (Born.) Kuck.:– BARBADOS: St. Peter Parish, Heywoods Beach, no. 68-423.

ECTOCARPUS Lyngbye, 1819

E. confervoides (Roth) LeJol.:– ANTIGUA: St. Philip Parish, Fanneys Cove, no. 67-248.

E. breviarticulatus J. Agardh:– GRAND CAYMAN: East End, Gun Bay, no. 67-60. ANTIGUA: St. John Parish, Loblolly Bay, no. 67-294B; St. Philip Parish, Fanneys Cove, no. 67-263C. DOMINICA: St. Paul Parish, 1.6-3.2 km. south of the Layou River, no. 67-330; St. Joseph Parish, South of the Macoucherie River, no. 67-407; St. John Parish, Douglas Bay, no. 67-502; St. Mark Parish, Soufrière Bay, no. 67-441. ST. LUCIA: Gros Islet Quarter, La Brellotte Bay, no. 68-256, Jacks Beach, no. 68-411; Laborie Quarter, Laborie, no. 68-338A. BARBADOS: St. Peters Parish, Heywood Beach, no. 68-422, Six Mens Bay, no. 67-644; St. Lucy Parish, River Bay, no. 66-93, Little Bay, nos. 66-48, 68-445, Wickes Bay, no. 67-675; St. Andrew Parish, Windy Hill, no. 66-220.

E. rhodochortonoides Børg.:– Plants about 5 mm. tall, the filaments very sparingly branched, 8.5-14.0 μ diam., the cells 2.5-7.0 diameters long; gametangia often sessile, often on a slight pedicel which is a projection of the supporting cell, occasionally on a one-celled stalk, 18-28 μ diam., 26-47 μ long, with rather large cells. GRAND BAHAMA: West End, on old *Cystoseira* plant stalks in intertidal beach-rock pools, very abundant, no. 68-24.

These plants do not quite reach the maximum filament diameter (21 μ) cited by Børgesen, nor in the region of the gametangia do the cells become as long, but near the filament tips they approach his characterization more closely. Otherwise they agree quite well with his description. Text-figures 7-14.

GIFFORDIA Batters, 1893

G. mitchellae (Harv.) Hamel:– ANTIGUA: St. John Parish, Goat Hill Bay, no. 67-306; St. Philip Parish, Fanneys Cove, no. 67-253B. DOMINICA: St. Joseph Parish, south of the Macoucherie River, no. 67-409. BARBADOS: St. Lucy Parish, Little Bay, no. 66-49.

G. conifera (Børg.) W. R. Taylor (?):– ANTIGUA: St. Paul Parish, Crawle Bay, no. 67-218B.

G. duchassaingiana (Grun.) W. R. Taylor:– ANTIGUA: St. John Parish, Hodge Point, no. 67-141. DOMINICA: St. Paul Parish, 1.6-3.2 km. south of the Layou River, no. 67-329A. ST. LUCIA: Laborie Quarter, Laborie, no. 68-338C. BARBADOS: St. James Parish, Paynes Bay, no. 66-39.

SPHACELARIALES

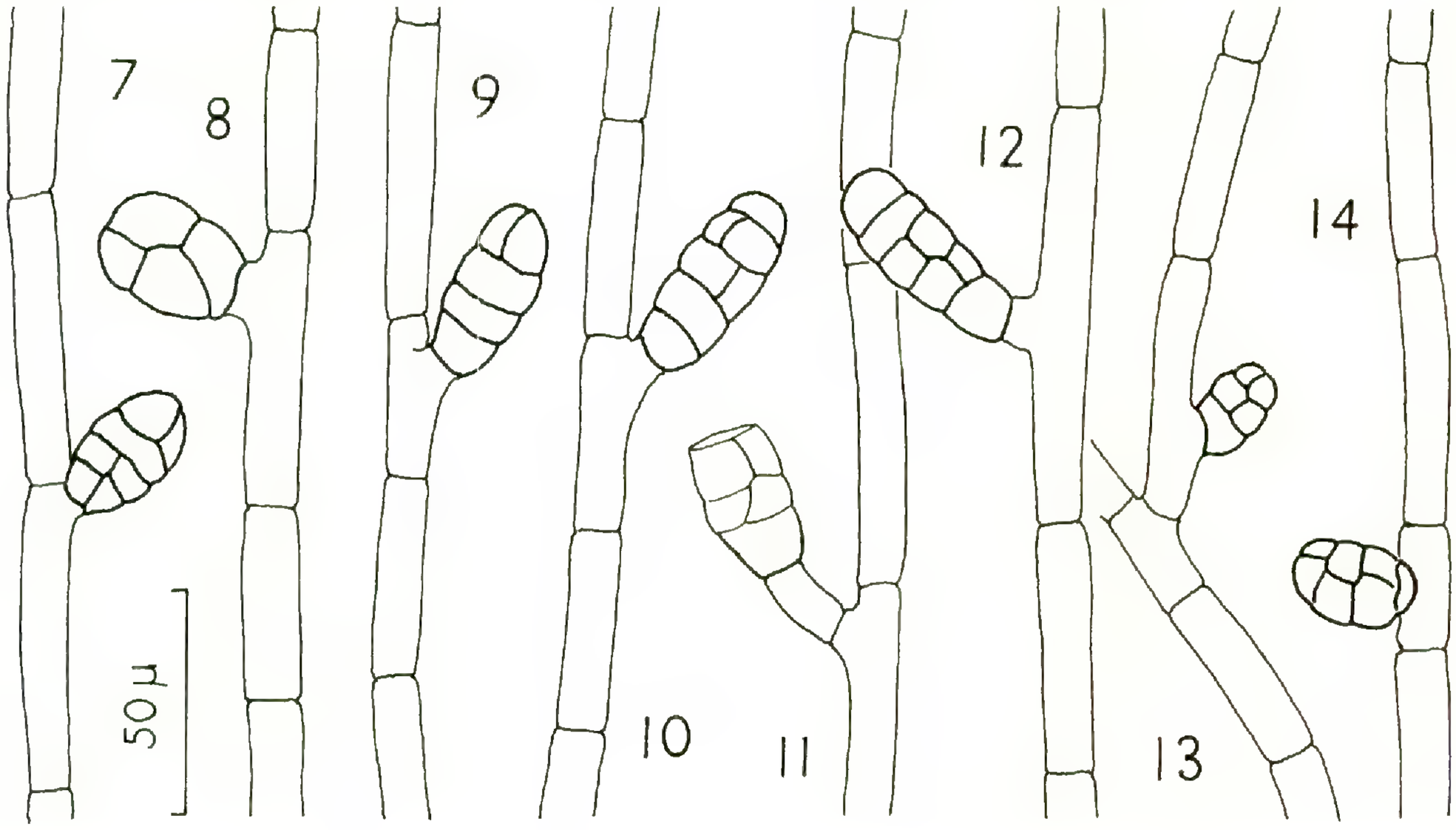
SPHACELARIACEAE

SPHACELARIA Lyngbye, 1819

S. furcigera Kütz.:– DOMINICA: St. Joseph Parish, 400 m. south of the Layou River, no. 67-336.

S. tribuloides Menegh.:– ANTIGUA: St. John Parish, Loblolly Bay, no. 67-290, Port Royal Bay, no. 67-154. DOMINICA: St. Paul Parish, 1.6-3.2 km. south of the Layou River, no. 67-325. BARBADOS: St. Lucy Parish, Little Bay, no. 67-840.

S. novae-hollandiae Sond.:– BARBADOS: St. Lucy Parish, Little Bay, no. 68-446.



Text-figures 7–14. *Ectocarpus rhodochortonoides.* Portions of erect filaments showing gametangia, that in fig. 11 having discharged. Grand Bahama.

DICTYOTALES

DICTYOTACEAE

DILOPHUS J. Agardh, 1882

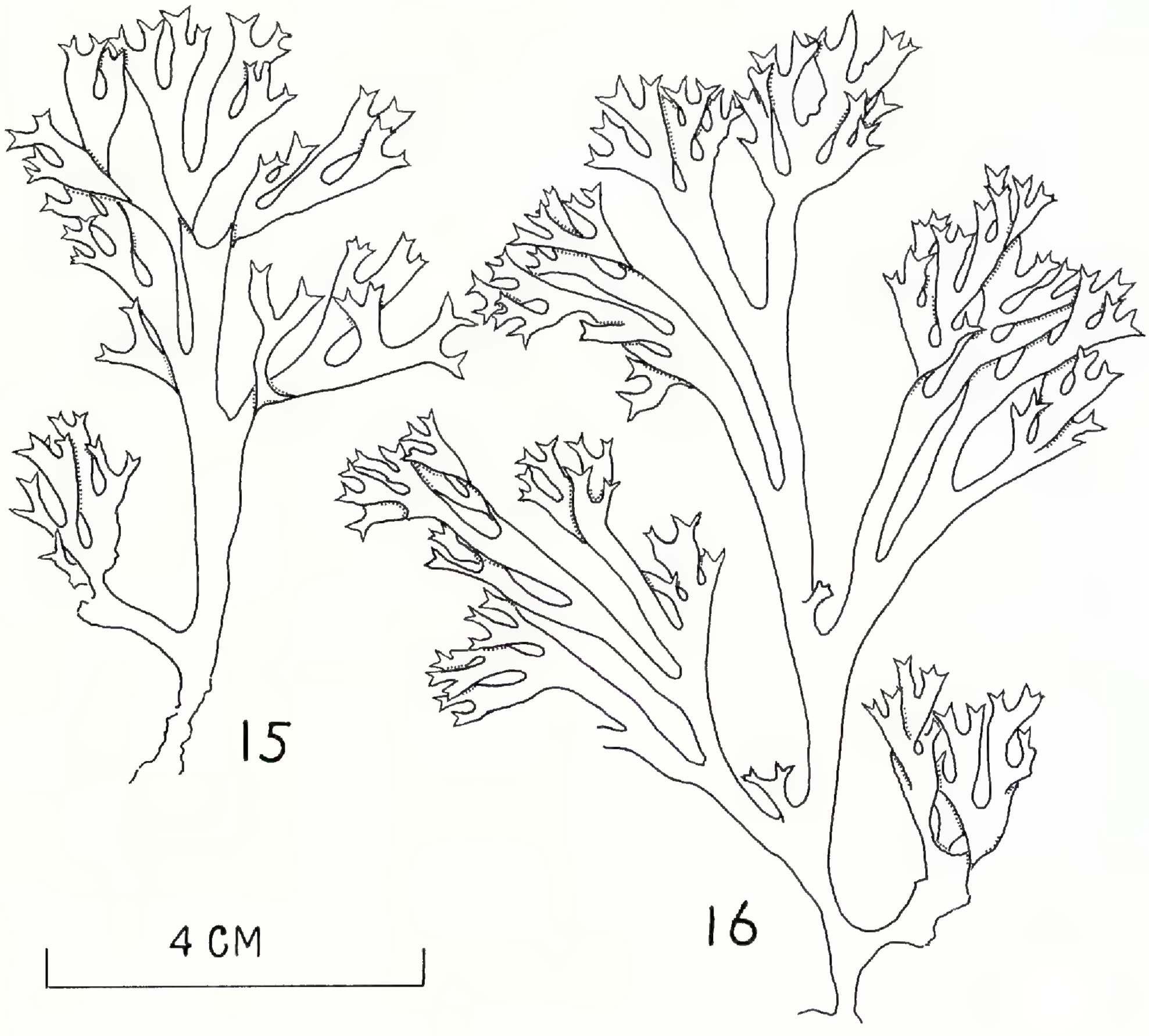
D. guineensis (Kütz.) J. Agardh:– GRAND CAYMAN: West Shore, near West Indian Club, no. 67-11; East End, Old Isaacs, nos. GRP-A.2521. ST. KITTS: St. Peter Basseterre Parish, Conaree Beach, no. 68-44. ANTIGUA: St. John Parish, Loblolly Bay, no. 67-298, Wetherell Point, no. 66-406, Hodge Point, no. 67-133B; St. George Parish, Judge Bay, no. 67-183. DOMINICA: St. Paul Parish, 1.2 km. south of the Layou River, no. 67-365; St. Joseph Parish, south of the Layou River, no. 67-394, south of the Macoucherie River, no. 67-411; St. Mark Parish, Scotts Head, no. R-294A. ST. LUCIA: Castries Quarter, Grande Cul de Sac, no. 68-363A, Gros Islet Quarter, La Brellotte Bay, no. 68-302. BARBADOS: St. Michael Parish, east of Needham Point, no. 67-704; St. Lucy Parish, River Bay, nos. 66-77, 67-687; St. John Parish, Bath Bay, no. 66-159; Christ Church Parish, St. Lawrence Bay, nos. 66-185, 68-499. ST. VINCENT: St. George Parish, Calliaqua, no. 66-342. BEQUIA: Adams Beach, no. 66-398A.

D. alternans J. Agardh var. **alternans**:– ANTIGUA: St. John Parish, Wetherell Point, no. 66-472, Hodge Point, no. 66-419D; St. George Parish, Judge Bay, nos. 66-469, 67-

184; St. Paul Parish, Crawle Bay, no. 67-225. DOMINICA: St. Andrew Parish, Calibishie Bay, no. 67-579. ST. LUCIA: Gros Islet Quarter, La Brellotte Bay, no. 68-317. BARBADOS: St. James Parish, Payne Bay, no. 68-559; St. John Parish, Bath Bay, no. 66-227.

————————, ————————, forma **acutissima** fa. nov.:— Plantae typo speciei similes; rami 1.5-4.0 mm. lat. super furcas, apicibus divergentibus et acutissimis. Planta typica e loco I. St. Lucia, Gros Islet Quarter, La Brellotte Bay dicto, a W. R. Taylor lecta, no. 66-288, 17 iii 68; in Herbario Universitatis Michiganensis deposita.

Plants similar to the type of the species; but branches 1.5-4.0 μ broad above the forks, the apices divergent and very acute. ST. LUCIA: Castries Quarter, Grande Cul de Sac Bay, no. 68-363B; Gros Islet Quarter, La Brellotte Bay, no. 68-288.



Text-figures 15, 16. *Dilophus alternans* fa. *acutissima.* Upper portions of two plants. St. Lucia.

These plants have in common very divergently and acutely bifid branch tips. This is a character seen in one growth phase of *Dictyota dentata,* but not expected in *Dilophus,* where the branching habit is quite different. They greatly resemble Mazé and Schramm's *Dictyota dichotoma* var. *prolifera* no. 387 from Guadeloupe (in the Kew herbarium specimen), but the branching is more equal, the tips sharper. Like it they are notably proliferous from the faces of the branches. The varietal name is not applied to specimens of this number in the 1870-77 text, nor does it appear in the earlier issues where specimen numbers are not used. Text-figures 15, 16.

DICTYOTA Lamouroux, 1809

D. dichotoma (Huds.) Lamx., var. **dichotoma**:– GRAND CAYMAN: West Shore near West Indian Club, no. 67-14. NEVIS: St. James Windward Parish, Mosquito Bay, no. 68-180. ANTIGUA: St. John Parish, Loblolly Bay, no. 67-297, Hodge Point, no. 66-420; St. George Parish, Judge Bay, nos. 67-160, 67-182A; St. Paul Parish, Crawle Bay, no. 67-227. BARBADOS: St. James Parish, Coral Reef Club near Holetown, no. 67-696; St. John Parish, Bath Bay, no. 66-160. ST. VINCENT: St. George Parish, Calliaqua, no. GRP-A.5309; St. Andrew Parish, Camden Beach, no. 66-334.

————, var. **menstrualis** Hoyt:– GRENADA: St. Andrew Parish, Grenville Beach, no. 66-281.

D. linearis (C. Agardh) Grev.:– GRAND CAYMAN: West Shore near West Indian Club, no. 67-12(?). ANTIGUA: St. George Parish, Judge Bay, no. 67-181A. ST. VINCENT: St. George Parish, Calliaqua, no. GRP-A.5288.

D. bartayresii Lamx.:– ANTIGUA: St. John Parish, Pinchin Bay, no. 67-283; St. Peter Parish, Six Mens Bay, no. 67-653; St. Paul Parish, Mamora Bay, no. 67-312. BARBADOS: St. James Parish, off Colony Club area near Holetown, at 10-14 m. depth, no. 67-653.

D. volubilis Kütz.:– ANTIGUA: St. George Parish, Judge Bay, no. 67-180.

D. divaricata Lamx.:– ST. KITTS: St. John Capisterre Parish, Dieppe Bay, no. 68-58. NEVIS: St. Thomas Lowland Parish, Jones Bay, no. 68-152. ANTIGUA: St. John Parish, Port Royal Bay, no. 66-490, Hodge Point, no. 66-448B; St. George Parish, Judge Bay, no. 67-181B; St. Paul Parish, Crawle Bay, no. 67-226. DOMINICA: St. John Parish, Douglas Bay, no. 67-490. ST. LUCIA: Gros Islet Parish, La Brellotte Bay, no. 68-290. ST. VINCENT: St. George Parish, Calliaqua, no. GRP-A.5237. BEQUIA: Friendship Bay, no. 66-369C.

D. indica Sonder:– NEVIS: St. Thomas Lowland Parish, Pinneys Beach, no. 68-137, Jones Beach, no. 68-150. DOMINICA: St. Joseph Parish, south of the Macoucherie River, no. 67-386.

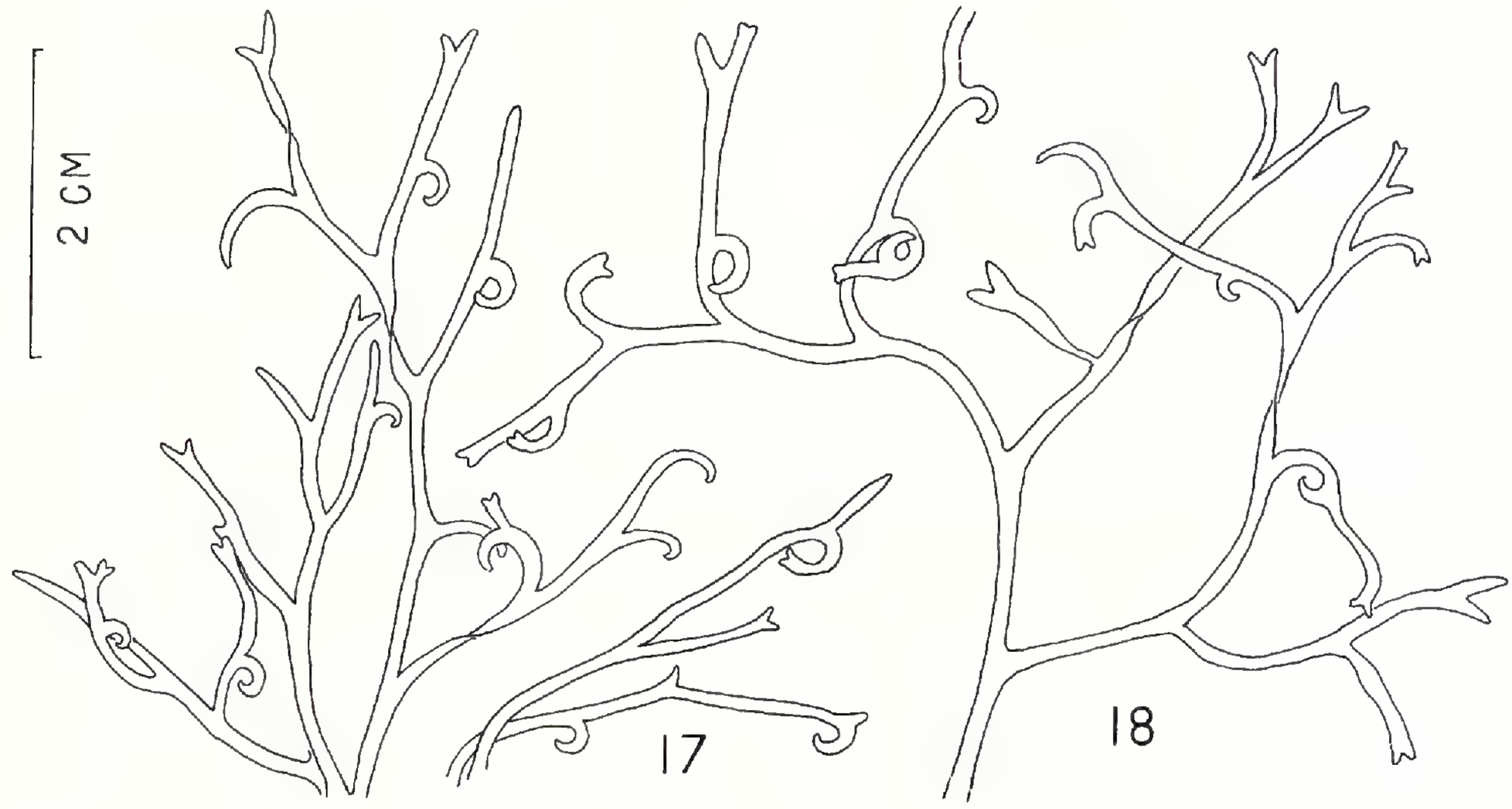
D. cervicornis Kütz.:– GRAND CAYMAN: East End, Gun Bay, no. 67-58. NEVIS: St. Thomas Lowland Parish, Pinneys Beach, no. 68-140A. ANTIGUA: St. George Parish, Judge Bay, no. 67-186. DOMINICA: St. John Parish, Prince Rupert Bay, no. 67-480. BARBADOS: St. Michael Parish, Carlisle Bay, no. 67-763; St. John Parish, Bath Bay, nos. 66-157 (?), 67-670.

———— var. **cervicornis** f. **curvula** fa. nov.:– Plantae satis parvae, 6-10 cm. alt., irregulariter ramosae, uno membro furcae non ramoso aut minus ramoso quam alterum et curvatissimo. Planta typica e loco I. Dominica, Paroecia St. Joseph dicto e litore meridionali fluminis Macoucherie, sed versus septentriones loci Méro dicti, a W. R. Taylor & C. F. Rhyne lecta, no. 67-385, 20 ii 67; in Herbario Musei Nationalis Civitatum Unitarum in loco Washington D.C. dicto deposita.

Plants rather small, 6-10 cm. tall, irregularly branched, with one member of the fork unbranched or less branched than the other, and very strongly curved. DOMINICA: St. Joseph Parish, from the shore south of the Macoucherie River but north of Méro, no. 67-385; St. John Parish, Prince Rupert Bay, Portsmouth Harbor, no. S&W-27716.

These plants seem very close to Mazé and Schramm's *D. dichotoma* fa. *curvula* Crouan mscpt., according to the specimen no. 981 in the British Museum (Nat. Hist.) herbarium. The curved branches are, indeed, even more evident. The name

appears without a pertinent description in their 1870-77 text, and, since the branchings are commonly unequal, I would prefer to associate the form with *D. cervicornis.* Even in a genus with species as variable as in this, form names are useful to call attention to features of variation otherwise disregarded and forgotten. Text-figures 17, 18.



Text-figures 17, 18. *Dictyota cervicornis* fa. *curvula.* Upper portions of two plants. Dominica.

D. ciliolata Kütz., var. **ciliolata**:– ANTIGUA: St. John Parish, Wetherell Point, no. 66-477, Hodge Point, no. 67-258. ST. KITTS: St. John Capisterre Parish, Dieppe Bay, no. 68-57. DOMINICA: St. John Parish, Prince Rupert Bay, no. 67-471; St. Andrew Parish, Calibishie Bay, no. 67-583; St. Mark Parish, Scotts Head, no. R-300. BARBADOS: St. Michael Parish, Gravesend, no. 67-783; St. Peter Parish, Bayfield, no. 66-26; St. Lucy Parish, River Bay, no. 67-807, Little Bay, no. 67-833; Christ Church Parish, St. Lawrence Bay, no. 66-187. ST. VINCENT: St. George Parish, Calliaqua, no. GRP-A.5250.

————————, var. **bermudensis** W. R. Taylor (?):– BARBADOS: St. John Parish, Bath Bay, no. 66-231.

D. jamaicensis W. R. Taylor:– ANTIGUA: St. John Parish, Hodge Bay, no. 67-258(?). ST. LUCIA: Gros Islet Quarter, La Brellotte Bay, no. 68-289. BARBADOS: St. James Parish, Paynes Bay, no. 66-38; St. Peter Parish, Heywoods Beach, no. 68-428, Six Mens Bay, no. 68-794; St. Lucy Parish, Little Bay, no. 68-442; Christ Church Parish, Silver Sands, no. 66-124. ST. VINCENT: St. George Parish, Calliaqua, no. GRP-A.5240; St. Andrew Parish, Camden Beach, no. 66-335A. BEQUIA: Adams Beach, no. 66-390.

D. dentata Lamx.:– GRAND BAHAMA: West End near hotel, no. 68-25. GRAND CAYMAN: West Shore near West Indian Club, no. 67-16, near West Bay Village, no. 67-101; North Shore, Grape Tree Point, no. GRP-A.2528. ST. KITTS: St. John Capisterre Parish, Dieppe Bay, no. 68-65; St. Peter Basseterre Parish, Conaree Bay, nos. GRP-A.3133, 68-43, North Frigate Bay, no. 68-94. NEVIS: St. Thomas Lowland Parish, Jones Bay, no. 68-151. ANTIGUA: St. John Parish, Hodge Point, nos. 66-421, 67-136; St. George Parish, Judge Bay, no. 66-468. ST. LUCIA: Gros Islet Quarter, La Brellotte Bay, no. 68-324. DOMINICA: St. Paul Parish, 1.2 km.

south of the Layou River, no. 67-357; St. Joseph Parish, south of the Macoucherie River, no. 67-387; St. Andrew Parish, Calibishie Bay, no. 67-543; St. Mark Parish, Atlantic side of Scotts Head, no. 62-449. ST. VINCENT: St. George Parish, Calliaqua, no. 66-345B; St. Andrew Parish, Camden Beach, no. 66-335B. BARBADOS: St. Lucy Parish, River Bay, nos. 66-82, 67-690, 68-451; St. John Parish, Bath Bay, no. 66-148; Christ Church Parish, Oistins, no. 66-114A, St. Lawrence Bay, nos. 66-188, 67-720, 68-498. ST. VINCENT: St. George Parish, Calliaqua, no. GRP-A.5283. GRENADA: St. George Parish, Martins Bay, no. 66-295(?); St. Patrick Parish, Levera Beach, no. 66-291; St. Andrew Parish, Marquis Beach, no. 66-279.

SPATOGLOSSUM Kützing, 1843

S. schroederi Kütz.:– NEVIS: St. George Gingerland Parish, Indian Castle Estate, no. 68-246. BARBADOS: Christ Church Parish, Oistins, no. 67-625, Hastings, no. 66-198. GRENADA: St. George Parish, Point Salines, Black Beach, no. 66-258; Charlotte Parish, Peruvian Vale, no. 66-350.

DICTYOPTERIS Lamouroux, 1809

D. justii Lamx.:– NEVIS: St. James Windward Parish, Mosquito Bay, no. 68-181; St. George Gingerland Parish, Indian Castle Estate, no. 68-237. ANTIGUA: St. John Parish, Hodge Point, no. 66-441. BARBADOS: Christ Church Parish, Silver Sands, no. 66-123, Oistins, no. 67-626, St. Lawrence Bay, nos. 66-192, 67-723, 68-500. ST. VINCENT: Charlotte Parish, Peruvian Vale, no. 68-348. GRENADA: St. George Parish, Point Salines, Black Bay, no. 66-259.

D. delicatula Lamx.:– ST. KITTS: St. Peter Basseterre Parish, Conaree Beach, no. 68-681 (*p.p.* with *Sargassum hystrix*). NEVIS: St. James Windward Parish, Sea Haven Estate, no. 68-238. ANTIGUA: St. George Parish, Judge Bay, no. 67-163; St. Philip Parish, Exchange Bay, no. 66-452; St. Paul Parish, Crawle Bay, no. 67-224. DOMINICA: St. George Parish, Roseau, no. 67-355; St. Joseph Parish, south of the Macoucherie River, nos. 67-401, 67-408; St. Mark Parish, Scotts Head, no. R-294B. BARBADOS: St. Lucy Parish, River Bay, no. 67-691, Little Bay, no. 67-834; St. Joseph Parish, Cattle Wash, no. 66-3; Christ Church Parish, Oistins, no. 66-112. ST. VINCENT: St. George Parish, Argyle, no. 66-355, Calliaqua, no. GRP-A.5239; Charlotte Parish, Peruvian Vale, no. 66-349. BEQUIA: Adams Beach, no. 66-397. GRENADA: Black Bay, Point Salines, no. 66-270A; St. Andrew Parish, Marquis Beach, no. 66-277.

D. jamaicensis W. R. Taylor:– BARBADOS: Christ Church Parish, Silver Sands, no. 66-124; Oistins, no. 67-627.

D. plagiogramma (Mont.) Vick.:– GRENADA: St. Patrick Parish, Levera Beach; no. 66-289.

POCOCKIELLA Papenfuss, 1943

P. variegata (Lamx.) Papenf.:– GRAND CAYMAN: West Shore near West Indian Club, no. 67-22. ST. KITTS: St. George Basseterre Parish, North Friars Bay, no. GRP-A.3180. NEVIS: St. Thomas Lowland Parish, Pinneys Beach, no. 68-120B; St. James Windward Parish, Mosquito Bay, no. 68-192. ANTIGUA: St. John Parish, Loblolly Bay, no. 67-290, Wetherell Point, no. 66-405, Soldiers Bay, no. 67-156, Hodge Point, no. 66-405; St. George Parish, Judge Bay, no. 66-467A. DOMINICA: St. Andrew Parish, Calibishie Bay, nos. 67-542, 67-578, R-184; St. Mark

Parish, Scotts Head, no. R-289. BARBADOS: St. John Parish, Bath Bay, no. 66-172, Conset Bay, no. 68-548; Christ Church Parish, Silver Sands, no. 66-127, Oistins, no. 66-117B, St. Lawrence Bay, no. 67-722. GRENADA: St. George Parish, Point Salines, Black Bay, no. 66-257.

STYPOPODIUM Kützing, 1843

S. zonale (Lamx.) Papenf.:– GRAND CAYMAN: West Shore, near West Indian Club, no. 67-24; North Shore, Grape Tree Point, no. GRP-A.2490. NEVIS: St. James Windward Parish, Mosquito Bay, no. 68-193. DOMINICA: St. Marks Parish, Scotts Head on the Atlantic side, R-289. BARBADOS: St. John Parish, Bath Bay, no. 66-154. ST. VINCENT: St. George Parish, Calliaqua, no. GRP-A.5281.

PADINA Adanson, 1763

P. haitiensis Thivy (?):– ANTIGUA: St. Paul Parish, English Harbor dockyard, no. 66-439.

P. vickersiae Hoyt:– GRAND CAYMAN: East End, Gun Bay, no. 67-61. ST. KITTS: St. George Basseterre Parish, Frigate Bay, no. 68-98. NEVIS: St. James Windward Parish, Mosquito Bay, no. 68-182(?), 68-185. ANTIGUA: St. John Parish, Wetherell Point, no. 67-259. DOMINICA: St. Joseph Parish, south of the Macoucherie River, no. 67-381. ST. LUCIA: Gros Islet Parish, La Brellotte Bay, no. 68-258. BARBADOS: St. James Parish, Paynes Bay, nos. 66-47, 68-556; St. Peter Parish, Six Mens Bay, no. 66-28; St. Lucy Parish, River Bay, nos. 67-692, 67-805; St. John Parish, Bath Bay, no. 66-189; Christ Church Parish, Oistins, nos. 66-121, 67-633. ST. VINCENT: St. George Parish, Calliaqua, nos. GRP-A.5287, 66-340; St. Andrew Parish, Camden Beach, no. 66-332.

P. sanctae-crucis Børg.:– GRAND CAYMAN: West Shore near Pageant Beach Hotel, no. 67-80; North Shore, Grape Tree Point, no. GRP-A.2481. NEVIS: St. James Windward Parish, Mosquito Bay, no. 68-183. ANTIGUA: St. John Parish, Wetherell Point, no. 66-471, Hodge Point, nos. 66-434, 67-139; St. George Parish, Fitches Creek, no. 67-316; St. Philip Parish, Exchange Bay, no. 66-459; St. Paul Parish, Crawle Bay, nos. 67-218A, 67-219. DOMINICA: St. John Parish, Prince Rupert Bay, no. 67-466. BARBADOS: St. Michael Parish, Gravesend, no. 67-781; Carlisle Bay, no. 67-757; St. Lucy Parish, River Bay, nos. 66-80, 67-689, Little Bay, no. 68-438; St. John Parish, Bath Bay, no. 66-155. ST. VINCENT: St. George Parish, Calliaqua, no. GRP-A.5288.

P. gymnospora (Kütz.) Vick.:– GRAND CAYMAN: West Shore, West Indian Club, no. 67-23. NEVIS: St. James Windward Parish, Mosquito Bay, no. 68-182. ANTIGUA: St. John Parish, St. John Harbor, no. 67-269, Hodge Point, no. 66-415A(?). DOMINICA: St. Joseph Parish, 400 m. south of the Layou River, no. 67-340; St. John Parish, Prince Rupert Bay, no. 67-466; St. Andrew Parish, Calibishie Bay, no. 67-555; St. Mark Parish, Soufrière Bay, no. R-269. ST. LUCIA: Castries Quarter, La Toc Bay, no. 68-407. BARBADOS: St. Michael Parish, Gravesend, no. 67-706; St. James Parish, Paynes Bay, no. 68-558; St. Lucy Parish, River Bay, no. 67-809, Wickes Bay, no. 67-673; St. John Parish, Bath Bay, nos. 66-158, 67-668. BEQUIA: Adams Beach, no. 66-386.

CHORDARIALES

MYRIONEMATACEAE

MYRIONEMA Greville, 1827

M. strangulans Grev.(?):– GRAND CAYMAN: South Shore east of Boddentown near "Joe Conyers", no. 67-38B.

RALFSIACEAE

RALFSIA Berkeley, 1831

R. expansa J. Agardh (?):– ANTIGUA: St. John Parish, Hodge Point, no. 66-438B; St. Philip Parish, Exchange Bay, no. 66-465.

CHORDARIACEAE

CLADOSIPHON Kützing, 1843

C. occidentalis Kylin:– GRAND BAHAMA: West End near hotel, no. 68-6.

PUNCTARIALES

PUNCTARIACEAE

COLPOMENIA Derbès & Solier, 1856

C. sinuosa (Roth) Derb. & Sol.:– ST. KITTS: St. John Capisterre Parish, Dieppe Bay, no. 68-61; St. Peter Basseterre Parish, North Frigate Bay, no. 68-96. NEVIS: St. James Windward Parish, Mosquito Bay, no. 68-186, Sea Haven Estate, no. 68-211; St. George Gingerland Parish, Indian Castle Estate, no. 68-240. ANTIGUA: St. George Parish, Judge Bay, nos. 66-467, 67-192. DOMINICA: St. Andrew Parish, Calibishie Bay, no. 67-530; St. Mark Parish, Soufrière Bay, no. 67-429. ST. LUCIA: Dauphin Quarter, Grand Anse, no. 68-387; Laborie Quarter, Laborie, no. 68-340. BARBADOS: St. Michael Parish, Gravesend, no. 67-768; St. Lucy Parish, River Bay, no. 67-821; St. John Parish, Bath Bay, no. 66-150; Christ Church Parish, Silver Sands, no. 66-131, St. Lawrence Bay, nos. 66-199, 68-496.

HYDROCLATHRUS Bory, 1826

H. clathratus (Bory) Howe:– BARBADOS: St. John Parish, Bath Bay, no. 66-151.

ROSENVINGEA Børgesen, 1917

R. floridana (W. R. Taylor) W. R. Taylor:– NEVIS: St. Thomas Lowland Parish, Pinneys Beach, no. 68-144. ST. VINCENT: St. Patrick Parish, Barrouallie, no. 66-325. Plants more slender than the type, the branch tips filiform.

R. intricata (J. Agardh) Børg.:– GRAND BAHAMA: West End, no. 68-33. BARBADOS: Christ Church Parish, Oistins, no. 67-738.

R. sanctae-crucis Børg.:– BARBADOS: St. Lucy Parish, River Bay, no. 67-682A. DOMINICA: St. John Parish, Prince Rupert Bay, Portsmouth Harbor, no. S & W 27825.

CHNOOSPORA J. Agardh, 1847

C. minima (Her.) Papenf.:– ST. VINCENT: Charlotte Parish, Spring, north of Peruvian Vale, no. 66-401. GRENADA: St. George Parish, Grand Anse Beach, no. 66-313.

FUCALES

SARGASSACEAE

CYSTOSEIRA C. Agardh, 1820

C. myrica (Gmel.) J. Agardh:— GRAND BAHAMA: West End, on the south shore, no. 68-23.

SARGASSUM C. Agardh, 1820

S. filipendula C. Agardh:— ST. KITTS: St. John Capisterre Parish, Dieppe Bay, no. 68-67 (?).

S. acinarium (L.) C. Agardh:— GRAND BAHAMA: West End, south shore, F. K. Sparrow. GRAND CAYMAN: West Shore near West Indian Club, no. 67-27; South Shore east of Boddentown, near "Joe Conyers", no. 67-30. ANTIGUA: St. John Parish, Port Royal Bay, no. 67-157(?); St. Paul Parish, Crawle Bay, no. 67-233. ST. LUCIA: Dauphin Quarter, Grand Anse Beach, no. 68-386(?). BARBADOS: St. Lucy Parish, River Bay, no. 67-694A(?), Little Bay, no. 66-62.

S. rigidulum Kütz.:— St. John Parish, Loblolly Bay, no. 67-288(?). DOMINICA: St. David Parish, Rosalie, no. 67-453. BARBADOS: St. Lucy Parish, River Bay, nos. 66-88, 67-802, Little Bay, nos. 66-61, 67-828; St. Andrew Parish, Chalky Mount, no. 68-467; St. Joseph Parish, Cattle Wash, no. 66-9.

S. vulgare C. Agardh, var. **vulgare**:— NEVIS: St. James Windward Parish, Mosquito Bay, nos. 68-190, 68-191. ANTIGUA: St. Philip Parish, Exchange Bay, no. 66-454A; St. Paul Parish, Crawle Bay, no. 67-235. DOMINICA: St. George Parish, Roseau, no. 67-347; St. Paul Parish, 1.6-3.2 km. south of the Layou River, no. 67-332, 1.2 km. south of the Layou River, no. 67-376; St. Andrew Parish, Calibishie Bay, no. 67-560; St. David Parish, Rosalie, no. 67-455; St. Mark Parish, Soufrière Bay, nos. 67-430, R-302. ST. LUCIA: Dauphin Quarter, Grand Anse Beach, no. 68-384; Vieux Fort Quarter, Anse des Sables, no. 68-330. BARBADOS: St. James Parish, Paynes Bay, nos. 66-42, 68-563; St. Lucy Parish, River Bay, no. 67-694B, Little Bay, nos. 67-828, 68-436; St. Joseph Parish, Cattle Wash, no. 66-8; St. John Parish, Bath Bay, nos. 67-656, 68-527, 68-529B. ST. VINCENT: St. George Parish, Argyle, no. 66-356(?); St. Patrick Parish, Barrouallie, no. 66-323. BEQUIA: Princess Margaret Beach, no. 66-400, Adams Beach, no. 66-394. GRENADA: St. Andrew Parish, Grenville Beach, nos. 66-285, 66-305, Marquis Beach, no. 66-276.

————————, var. **foliosissimum** (Lamx.) C. Agardh:— ST. KITTS: St. Peter Basseterre Parish, Conaree, no. 68-40. DOMINICA: St. John Parish, Prince Rupert Bay, no. 67-476. ST. LUCIA: Castries Quarter, Grande Cul de Sac, no. 68-352. BARBADOS: St. Joseph Parish, Cattle Wash, no. 66-7. ST. VINCENT: St. George Parish, Rose Cottage, G. R. Cooley no. A.8515. BEQUIA: Friendship Bay, no. 66-359. GRENADA: St. Andrew Parish, Grenville Beach, no. 66-306.

S. polyceratium Mont., var. **polyceratium**:— GRAND CAYMAN: West Shore near West Indian Club, no. 67-26. ANTIGUA: St. John Parish, Port Royal Bay, no. 66-488, Hodge Point, no. 66-414; St. Philip Parish, Exchange Bay, no. 66-454B.

————————, var. **ovatum** (Coll.) W. R. Taylor:— GRAND CAYMAN: West Shore near Pageant Beach Hotel, no. 67-86.

S. furcatum Kütz.:— DOMINICA: St. Mark Parish, Atlantic side of Scotts Head, no. 67-448.

S. hystrix J. Agardh, var. **hystrix**:— GRAND BAHAMA: West End, south shore, F. K.

Sparrow. ST. KITTS: St. John Capisterre Parish, Dieppe Bay, no. 68-68(?), North Frigate Bay, no. 68-94B. DOMINICA: St. David Parish, Rosalie, no. 67-452. ST. LUCIA: Vieux Fort Quarter, Anse des Sables, no. 68-332. BARBADOS: St. Lucy Parish, River Bay, no. 68-457(?); St. John Parish, Conset Bay, no. 68-539A; Christ Church Parish, Oistins, no. 67-636. GRENADA: St. Andrew Parish, Grenville Beach, no. 66-284.

————————, var. **buxifolium** (Chauv.) J. Agardh:— ST. LUCIA: Dauphin Quarter, Grand Anse Beach, no. 68-385C(?). BARBADOS: St. John Parish, Bath, no. 66-229, Conset Bay, no. 68-539B; Christ Church Parish, Silver Sands, no. 66-132, St. Lawrence Bay, no. 67-713.

————————, var. **spinulosum** (Chauv.) J. Agardh:— BARBADOS: Christ Church Parish, Silver Sands, no. 66-134(?), GRENADA: St. George Parish, St. George Harbor, B. E. Dahlgren and A. E. Persaud, 22 II 22 (Field Mus. Nat. Hist.).

S. platycarpum Mont.:— GRAND CAYMAN: West Shore, West Indian Club, no. 67-89. ST. KITTS: St. George Basseterre Parish, Frigate Bay, no. 68-97. NEVIS: St. Thomas Lowland Parish, Jones Bay, no. 68-157. ANTIGUA: St. John Parish, Goat Hill Bay, no. 67-308, Loblolly Bay, no. 67-296, Hodge Point, no. 66-407; St. Philip Parish, Exchange Bay, no. 66-455. DOMINICA: St. David Parish, Rosalie, no. 67-454; St. Mark Parish, Scotts Head on the Atlantic Side, no. R-298. ST. LUCIA: Dauphin Quarter, Grand Anse, no. 68-380; Vieux Fort Quarter, Anse des Sables, no. 68-331. BARBADOS: St. Lucy Parish, River Bay, nos. 66-94, 67-804, Little Bay, nos. 66-60, 68-435; St. Joseph Parish, Cattle Wash, no. 66-6; St. John Parish, Bath Bay, nos. 67-654 (with leaves commonly forked), 68-525; Christ Church Parish, Silver Sands, no. 66-133, St. Lawrence Bay, nos. 67-712, 68-497. GRENADA: St. Andrew Parish, Grenville Beach, no. 66-304C.

S. fluitans Børg.:— GRAND BAHAMA: West End near hotel, no. 68-14. GRAND CAYMAN: North Shore near North Side Village, no. 67-120, South Shore east of Boddentown near "Joe Conyers", no. 67-31. ST. KITTS: St. Peter Basseterre Parish, North Frigate Bay, no. 68-93. NEVIS: St. George Gingerland Parish, Indian Castle Estate, no. 68-243. ANTIGUA: St. John Parish, Wetherell Point, no. 66-267, Port Royal Bay, no. 66-489, Hodge Point, no. 66-413; St. George Parish, Judge Bay, no. 67-267; St. Philip Parish, Exchange Bay, no. 66-454. ST. LUCIA: Dauphin Quarter, Grand Anse Beach, no. 68-383; Vieux Fort Quarter, Anse des Sables, no. 68-328. BARBADOS: St. Lucy Parish, River Bay, no. 68-456; St. Andrew Parish, Windy Hill, no. 68-466; St. John Parish, Bath Bay, no. 68-530, Conset Bay, no. 68-540.

S. natans (L.) J. Meyen:— GRAND CAYMAN: North Shore near North Side Village, no. 67-119; East End, Gun Bay, no. 67-52. ST. KITTS: St. Peter Basseterre Parish, Conaree Beach, no. 68-39, North Frigate Bay, no. 68-92. NEVIS: St. George Gingerland Parish, Indian Castle Estate, no. 68-241. ANTIGUA: St. John Parish, Wetherell Point, nos. 66-404; St. George Parish, Judge Bay, no. 67-266; St. Philip Parish, Exchange Bay, no. 66-453. ST. LUCIA: Dauphin Quarter, Grand Anse, no. 68-381. BARBADOS: St. Lucy Parish, River Bay, no. 68-455, Little Bay, no. 68-437; St. Andrew Parish, Windy Hill, no. 68-465; St. John Parish, Bath Bay, no. 68-526, Conset Bay, no. 68-541.

TURBINARIA Lamouroux, 1828

T. costata Bart.:— GRAND CAYMAN: West Shore, near Pageant Beach Hotel, no. 67-116; East End, Old Isaacs, GRP-A.2745.

T. turbinata (L.) Kuntze:— GRAND BAHAMA: West End, no. 68-17(?). GRAND

CAYMAN: West Shore, West Indian Club, no. 67-17; South Shore east of Boddentown near "Joe Conyers", no. 67-43. ST. KITTS: St. Peter Basseterre Parish, Conaree Beach, no. GRP-A.3142, North Frigate Bay, no. 68-91. NEVIS: St. James Windward Parish, Sea Haven Estate, no. 68-195. ANTIGUA: St. John Parish, Hodge Point, nos. 66-416, 67-147. DOMINICA: St. Mark Parish, Soufrière Bay, no. R-301.

RHODOPHYCEAE

BANGIALES

BANGIACEAE

ERYTHROCLADIA Rosenvinge, 1909

E. subintegra Rosenv.:– DOMINICA: St. George Parish, Roseau, no. 67-353 (*p.p.* on *Chaetomorpha*). BARBADOS: St. Michael Parish, Bridgetown near "Pelican Village", no. 67-753 (*p.p.* on *Chaetomorpha*).

ERYTHROTRICHIA Areschoug, 1850

E. carnea (Dillw.) J. Agardh:– ANTIGUA: St. Peter Parish, Bayfield, no. 66-25 (*p.p.*, on *Dictyota*). BARBADOS: St. James Parish, off the Coral Reef Club near Holetown, no. 67-745 (*p.p.*, on *Polysiphonia*).

COMPSOPOGONACEAE

COMPSOPOGON Montagne, 1846

C. caeruleus (Balbis) Mont.:– DOMINICA: St. Andrew Parish, Woodford Hill River, no. R-248A.

HELMINTHOCLADIALES

ACROCHAETIACEAE

ACROCHAETIUM Nageli, 1862

A. liagorae Børg.:– BARBADOS: St. Michael Parish, Garrison, no. 67-786 (*p.p.*, in *Liagora*).

HELMINTHOCLADIACEAE

TRICHOGLOEA Kützing, 1849

T. requienii (Mont.) Kütz.:– BARBADOS: St. John Parish, Bath Bay, no. 66-145; Christ Church Parish, Oistins, nos. 67-615, 67-727A.

HELMINTHOCLADIA J. Agardh, 1851

H. calvadosii (Lamx.) Setch.:– DOMINICA: St. Andrew Parish, Woodford Hill Bay, no. R-250.

LIAGORA Lamouroux, 1812

L. farinosa Lamx.:– GRAND CAYMAN: West Shore near West Indian Club, no. 67-7. ST. KITTS: St. George Basseterre Parish, Frigate Bay, no. GRP-A.3159; St. John Capisterre Parish, Dieppe Bay, no. 68-56; St. Peter Basseterre Parish, Conaree Beach, no. 68-38. NEVIS: St. James Windward Parish, Sea Haven Estate Beach, nos. 68-199, 68-200. ST. LUCIA: Gros Islet Quarter, La Brellotte Bay, no. 68-257A. BARBADOS: St. Lucy Parish, River Bay, no. 68-449.

L. ceranoides Lamx.:– GRAND CAYMAN: East End, Gun Bay, no. 67-54, no. GRP-A.2517. ANTIGUA: St. John Parish, Wetherell Point, no. 66-481; St. George

Parish, Judge Bay, no. 67-172. DOMINICA: St. Joseph Parish, 400 m. south of the Layou River, no. 67-464 (det. I. A. Abbott); St. Andrew Parish, Calibishie Bay, no. 67-527 (det. as fa. *pulverulenta* by I. A. Abbott). BARBADOS: St. Michael Parish, Gravesend, no. 67-784; St. James Parish, Paynes Bay, no. 66-31, off Coral Reef Club area, nos. 67-789, 67-792; St. Lucy Parish, River Bay, no. 67-817; Christ Church Parish, Oistins, no. 67-616, 67-729.

L. valida Harv.:– GRAND CAYMAN: West Bay Village, no. 67-103; East End, Old Isaacs, no. GRP-A.2518. ST. KITTS: St. George Basseterre Parish, South Friars Bay, no. GRP-A.3175; St. John Capisterre Parish, Dieppe Bay, no. 68-60; St. Peter Basseterre Parish, Conaree Beach, no. 68-47. DOMINICA: St. John Parish, Prince Rupert Bay, no. 67-469 (det. I. A. Abbott). BARBADOS: St. Michael Parish, Gravesend, no. 67-785; St. Lucy Parish, River Bay, no. 66-76; St. John Parish, Bath Bay, no. 66-171, Conset Bay, no. 68-546; Christ Church Parish, Oistins, no. 67-730, St. Lawrence Bay, no. 67-721. ST. VINCENT: St. George Parish, Calliaqua, no. GRP-A.5274.

L. mucosa Howe:– GRAND CAYMAN: East End, Old Isaacs, no. GRP-A.2515. BARBADOS: St. James Parish, off Coral Reef Club area near Holetown, nos. 67-652, 67-786; Christ Church Parish, Oistins, no. 67-728.

L. pedicellata Howe:– BARBADOS: St. James Parish, at 10-14 m. off the Coral Reef Club area near Holetown, no. 67-652.

L. pinnata Harv.:– GRAND CAYMAN: West Shore near Pageant Beach Hotel, no. 67-81; West Bay Village, no. 67-102.

L. decussata Mont.:– DOMINICA: St. Paul Parish, 1.6-3.2 km. south of the Layou River, no. 67-329; St. John Parish, Douglas Bay, no. 67-501 (both det. verified by I. A. Abbott).

GALAXAURA Lamouroux, 1812

G. lapidescens (Soland.) Lamx.:– ST. LUCIA: Gros Islet Quarter, La Brellotte Bay, nos. 68-292, 68-396.

G. subverticillata Kjellm.:– GRAND CAYMAN: West Shore, near Pageant Beach Hotel, no. 67-84A; North Shore, Grape Tree Point, no. GRP-A.2754. ANTIGUA: St. John Parish, Wetherell Point, nos. 66-482, 67-263. DOMINICA: St. Mark Parish, Soufrière Bay, no. 67-435. ST. LUCIA: Gros Islet Quarter, La Brellotte Bay, no. 68-266. BARBADOS: St. James Parish, Paynes Bay, no. 66-32; St. Lucy Parish, River Bay, no. 68-462; Christ Church Parish, Oistins, no. 66-119, Rockley Beach, no. 67-710.

G. squalida Kjellm.:– GRAND CAYMAN: West Shore near Pageant Beach Hotel, no. 67-83; East End, Old Isaacs, no. GRP-A.2747. ST. KITTS: St. George Basseterre Parish, Frigate Bay, no. GRP-A.3170. NEVIS: St. James Windward Parish, Mosquito Bay, no. 68-178. ANTIGUA: St. John Parish, Goat Hill Bay, no. 67-306; Loblolly Bay, no. 67-292, Wetherell Point, nos. 66-474, 67-246B, Hodge Point, no. 67-242; St. Philip Parish, Exchange Bay, no. 66-462. DOMINICA: St. John Parish, Prince Rupert Bay, no. 67-474; St. Andrew Parish, Calibishie Bay, no. R-158; St. Mark Parish, Scotts Head on the Atlantic side, no. R-292, Soufrière Bay, no. R-306. ST. LUCIA: Gros Islet Quarter, La Brellotte Bay, no. 68-265. BARBADOS: St. James Parish, Coral Reef Club near Holetown, no. 67-697.

G. rugosa (Soland.) Lamx.:– GRAND CAYMAN: South Shore, Boddentown, no. 67-50. ST. KITTS: St. George Basseterre Parish, Frigate Bay, nos. 68-106, GRP-A.3161; St. Peter Basseterre Parish, Conaree Beach, no. GRP-A.3138. NEVIS: St. James

Windward Parish, Sea Haven Estate, no. 68-226. ANTIGUA: St. John Parish, Goat Hill Bay, no. 67-307, Wetherell Point, no. 66-483, Hodge Point, nos. 67-144, 67-242. DOMINICA: St. Paul Parish, 1.2 km. south of the Layou River, no. 67-372B; St. Andrew Parish, Calibishie Bay, no. 67-584; St. Mark Parish, Soufrière Bay, no. R-262. ST. LUCIA: Laborie Quarter, Laborie, no. 68-345. BARBADOS: St. James Parish, Paynes Bay, no. 66-46A, Coral Reef Club area near Holetown, no. 67-697; St. Peter Parish, Heywoods Beach, no. 68-432; Christ Church Parish, Hastings, no. 66-207. BEQUIA: Friendship Bay, no. 66-360. GRENADA: St. George Parish, Point Salines, Black Bay, no. 66-262B.

G. cylindrica (Soland.) Lamx.:– ST. KITTS: St. John Capisterre Parish, Dieppe Bay, no. 68-62; St. Peter Basseterre Parish, Conaree Beach, no. GRP-A.3139. NEVIS: St. George Gingerland Parish, Indian Castle Estate, no. 68-249. DOMINICA: St. Paul Parish, 1.2 km. south of the Layou River, no. 67-372C; St. Joseph Parish, south of the Macoucherie River, no. 67-377; St. Andrew Parish, Calibishie Bay, no. 67-545, R-202; Woodford Hill Bay, Pointe la Soie, no. R-233. ST. LUCIA: Gros Islet Quarter, La Brellotte Bay, no. 68-306. BARBADOS: St. Lucy Parish, River Bay, no. 66-75A; Christ Church Parish, St. Lawrence Bay, no. 68-501.

G. oblongata (Soland.) Lamx.:– ST. KITTS: St. John Capisterre Parish, Dieppe Bay, no. 68-63. ANTIGUA: St. John Parish, Wetherell Point, no. 67-264A. DOMINICA: St. Paul Parish, 1.2 km. south of the Layou River, no. 67-372; St. Joseph Parish, south of the Macoucherie River, no. 67-378. ST. LUCIA: Castries Quarter, Vigie Point, no. GRP-A.2799. BARBADOS: St. Lucy Parish, River Bay, no. 66-75; St. John Parish, Bath Bay, nos. 66-156, 66-164; Christ Church Parish, Oistins, no. 67-736. BEQUIA: Adams Beach, no. 66-372.

G. obtusata (Soland.) Lamx.:– NEVIS: St. James Windward Parish, Mosquito Bay, no. 68-177; St. George Gingerland Parish, Red Cliff, no. GRP-A.3224. ST. LUCIA: Castries Quarter, Grand Cul de Sac, no. 68-355. BARBADOS: St. John Parish, Bath Bay, no. 66-156.

G. marginata (Soland.) Lamx.:– ST. KITTS: St. John Capisterre Parish, Dieppe Bay, no. 68-64. NEVIS: St. James Windward Parish, Mosquito Bay, no. 68-166; St. George Gingerland Parish, Indian Castle Estate, no. 68-248. DOMINICA: St. Paul Parish, 1.2 km. south of the Layou River, no. 67-368; St. Joseph Parish, south of the Macoucherie River, no. 67-379; St. Andrew Parish, Calibishie Bay, no. 67-569, Woodford Hill Bay, Pointe La Soie, no. R-239. ST. LUCIA: Castries Quarter, Grande Cul de Sac, no. 68-366. BARBADOS: St. James Parish, Paynes Bay, no. 66-40; St. Peter Parish, Bayfield, no. 66-29. Six Mens Bay, no. 67-647; St. John Parish, Bath Bay, no. 66-165; Christ Church Parish, Oistins, no. 67-744. GRENADA: St. George Parish, Grand Anse, no. 66-317. BEQUIA: Adams Beach, no. 66-373.

BONNEMAISONIACEAE

ASPARAGOPSIS Montagne, 1841

A. taxiformis (Del.) Coll. & Herv.:– ANTIGUA: St. George Parish, Judge Bay, no. 67-161. DOMINICA: St. Andrew Parish, Calibishie Bay, no. R-159. BARBADOS: St. John Parish, Bath Bay, nos. 66-230, 67-858, Conset, no. 68-545; Christ Church Parish, Oistins, no. 67-732.

GELIDIALES

GELIDIACEAE

GELIDIELLA Feldm. & Hamel, 1934

G. trinitatensis W. R. Taylor:– GRAND CAYMAN: West Shore near Pageant Beach Hotel, no. 67-95. BEQUIA: Adams Beach, no. 66-399.

G. acerosa (Forssk.) Feldm. & Hamel:– GRAND CAYMAN: West Shore near Pageant Beach Hotel, no. 67-87; East End, Old Isaacs, no. GRP-A.2474. NEVIS: St. James Windward Parish, Sea Haven Estate, no. 68-223B. ANTIGUA: St. George Parish, Judge Bay, nos. 66-473, 67-189; St. Paul Parish, Crawle Bay, nos. 67-219, 67-230. DOMINICA: St. Andrew Parish, Calibishie Bay, nos. 67-541, R-189. ST. LUCIA: Castries Quarter, Grande Cul de Sac, no. 68-376; Gros Islet Quarter, La Brellotte Bay, no. 68-264; Laboria Quarter, Laborie, no. 68-344. BARBADOS: St. James Parish, Paynes Bay, no. 66-433; St. Peter Parish, Bayfield, no. 66-43, Six Mens Bay, no. 66-19, 67-646; St. Lucy Parish, Wickes Bay, no. 67-677; St. John Parish, Conset Bay, Vickers, Algues de la Barbade no. 118 (As *G. spathulatum* Kütz.) may be a form of this species. BEQUIA: Friendship Bay, no. 66-369. GRENADA: St. Georges Parish, Martins Bay, no. 66-293.

GELIDIOPSIS Schmitz, 1895

G. planicaulis (W. R. Taylor) W. R. Taylor:– ST. LUCIA: Gros Islet Quarter, La Brellotte Bay, no. 68-279. BARBADOS: St. Lucy Parish, River Bay, no. 67-814.

Some of the River Bay material had the branching almost palmate and chiefly toward the ends of the axes, resembling *Gelidiella taylori* Joly (1957), but the Barbados plants were coarser and had an entirely different type of apical growth. *Gelidium nanum* Grev. *sensu* Crouan in Mazè & Schramm, Algues de la Guadeloupe no. 207 (British Museum N.H. specimen) should also be considered, but is not at the present available for microscopic examination.

G. intricata (C. Agardh) Vick.:– GRENADA: St. George Parish, Martins Bay, no. 66-292 (*p.p.*, with *Gelidium*).

GELIDIUM Lamouroux, 1813

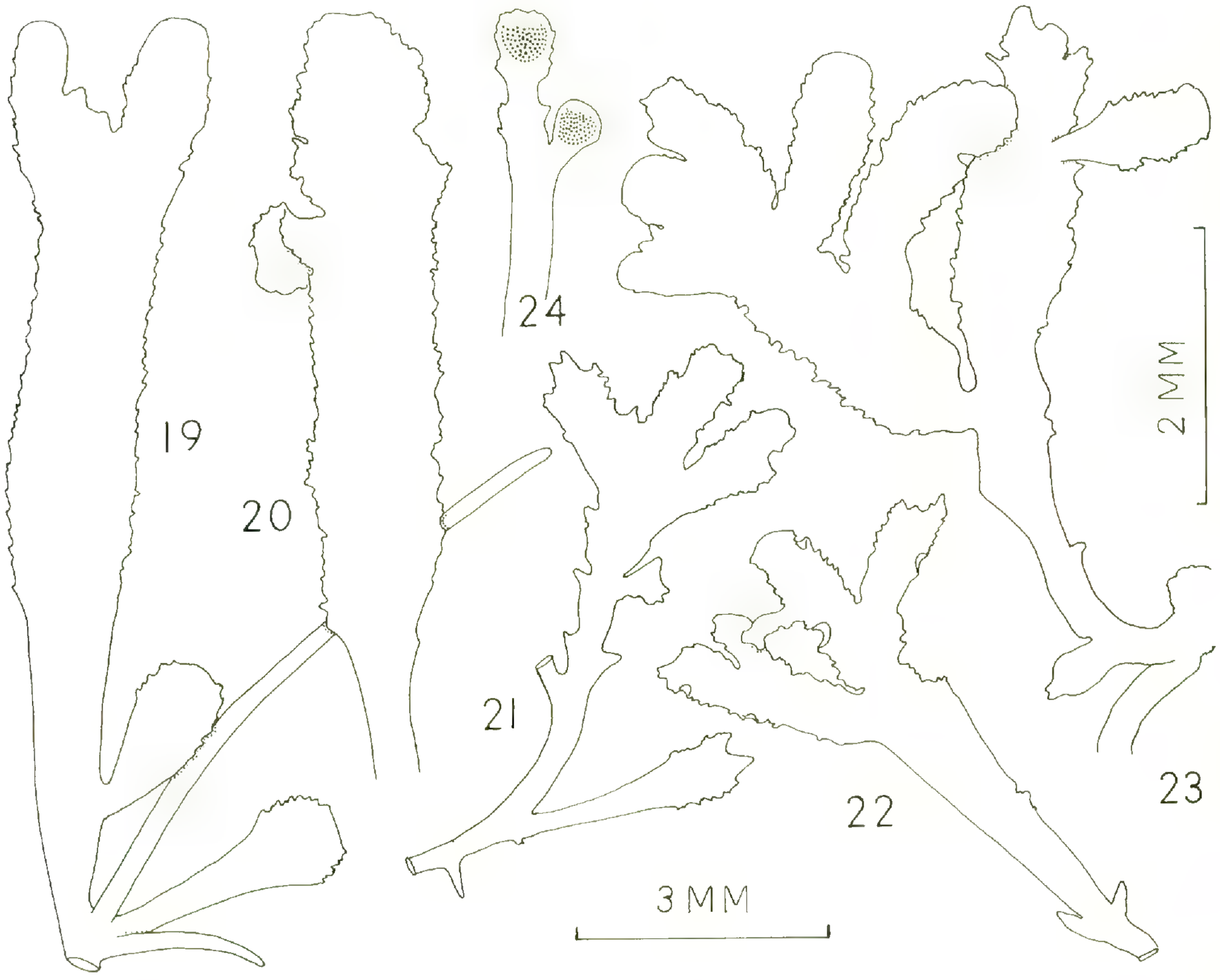
G. pusillum (Stackh.) Le Jolis, var. **conchicola** Picc. & Grun.:– DOMINICA: St. Andrew Parish, Calibishie Bay, no. 67-572. BARBADOS: St. Peter Parish, Six Mens Bay, no. 67-801B. GRENADA: St. George Parish, Martins Bay, no. 66-292.

G. microdonticum n. sp.:– Plantae ad 10-15 mm. alt., laminae stipitatae 0.75-1.25 mm. lat., ligulatae, simplices aut a marginibus parce atque irregulariter ramosae, basibus attenuatis, apicibus late rotundatis, lateribus plerumque parallelis, marginibus minute serrato-dentatis; tetrasporangia spherica, 23-32 μ diam., in soris subterminalibus in ramis innata. Planta typica e loco I. Barbados, Paroecia St. Lucy, Little Bay dicto, in petris littoralibus a W. R. Taylor et M. Goldstein lecta, no. 66-58, 19 ii 1966; in Herbario Universitatis Michiganensis deposita.

Plants to 10-15 mm. tall, the blades stalked, 0.75-1.25 mm. broad, ligulate, simple or sparingly and irregularly branched from the margins, the bases tapering, the apices broadly rounded, the sides generally parallel, the margins minutely, somewhat irregularly serrate-dentate. Tetrasporangia spherical, 23-32 μ diam., in subterminal sori on ordinary or somewhat narrow branches. BARBADOS: St. Lucy Parish, Little Bay, on littoral rocks, coll. W. R. Taylor and M. Goldstein, no. 66-58. TRINIDAD: St. George Parish, Maqueripe Bay, R. Thaxter 1912-13; St. David Parish, Matelot, W. D. Richardson no. 173, 1957.

Plants of this *Gelidium* formed a close turf on very refractory rocks subject to severe surf on Barbados. The branches are generally marginal without contracted

bases, but occasionally they arise from the blade face and then are stalked. The teeth are very distinct even though small, and occur about 8-10 to the millimeter. In section the blade medulla shows numerous large, very thick-walled cells, with between, but especially around them very many slender rhizines. The very distinct *G. serrulatum* J. Ag., a large species, is the other serrate one known from the West Indies, but this species is far smaller and does not suggest a dwarf form of *G. serrulatum.* Text-figures 19-24.



Text-figures 19–24. *Gelidium microdonticum.* Figs. 19, 20, 23. Portions of 3 plants showing various degrees of branching, with 2 mm. bar scale. Figs. 21,22, similar portions with 3 mm. bar. Fig. 24, tip of a branch with two sporangial sori, at the same scale. Figs. 19, 21, 22 show flagellar outgrowths near the base at various developmental stages. Fig. 23 is complete to the basal cushion. Barbados.

PTEROCLADIA J. Agardh, 1851

P. bartlettii W. R. Taylor:– ST. KITTS: St. Peter Basseterre Parish, Conaree Beach, no. 68-48A. DOMINICA: St. Paul Parish, 1.6-3.2 km. south of the Layou River, no. 67-331; St. Joseph Parish, south of the Macoucherie River, no. 67-380; St. John Parish, Prince Rupert Bay, no. 67-467. BARBADOS: St. Peter Parish, Six Mens Bay, no. 67-793; St. Lucy Parish, River Bay, no. 67-812, Little Bay, no. 67-837.

P. americana W. R. Taylor:– ANTIGUA: St. John Parish, St. John Harbor, causeway to Rat Island, no. 67-271. DOMINICA: St. John Parish, Prince Rupert Bay, no. 67-468.

P. pinnata (Huds.) Papenf.:– DOMINICA: St. Mark Parish, Scotts Head on the Atlantic side, no. R-297. BARBADOS: St. Lucy Parish, Fryer Well Point, no. 66-13.

WURDEMANNIACEAE

WURDEMANNIA Harvey, 1853

W. miniata (Drap.) Feldm. & Hamel:– DOMINICA: St. Mark Parish, Soufrière Bay, no. 67-438. BARBADOS: St. Lucy Parish, Little Bay, no. 67-844.

CRYPTONEMIALES

RHIZOPHYLLIDACEAE

OCHTODES J. Agardh, 1872

O. secundiramea (Mont.) Howe:– ST. KITTS: St. John Capisterre Parish, Black Rocks, no. GRP-A.3189. DOMINICA: St. Andrew Parish, Calibishie Bay, no. 67-577, R-191. ST. LUCIA: Gros Islet Quarter, La Brellotte Bay, no. 68-309. BARBADOS: St. James Parish, Heywoods Beach, no. 68-420; St. Peter Parish, Six Mens Bay, nos. 67-651, 68-797; Christ Church Parish, Hastings, no. 66-196. BEQUIA: Adams Beach, no. 66-387.

HILDENBRANDIACEAE

HILDENBRANDIA Nardo, 1834

H. rivularis (Liebm.) J. Agardh:– GRENADA: St. George Parish, Annandale Falls, no. 66-309. Abundant on rocks in the freshwater stream.

PEYSONNELIA Decaisne, 1841

P. rubra (Grev.) J. Agardh:– BARBADOS: St. James Parish, 60-70 m. depth off Miramar Hotel near Holetown, no. 66-136; St. Lucy Parish, Little Bay, no. 67-846.

CORALLINACEAE

FOSLIELLA Howe, 1920

F. lejolisii (Rosan.) Howe:– GRAND CAYMAN: West Shore near West Indian Club, no. 67-20. NEVIS: St. James Windward Parish, Sea Haven Estate, no. 68-214 (*p.p.*, on *Valonia*). DOMINICA: St. Andrew Parish, Calibishie Bay, no. 67-536, Woodford Hill Bay, no. R-230A (*p.p.*, on *Amansia*). BARBADOS: St. Lucy Parish, River Bay, no. 66-66B.

F. farinosa (Lamx.) Howe:– ST. KITTS: St. Peter Basseterre Parish, Conaree Beach, no. GRP-A.3127. ANTIGUA: St. John Parish, Hodge Point, no. 66-433. ST. LUCIA: Gros Islet Quarter, La Brellotte Bay, no. 68-301. DOMINICA: St. Andrew Parish, Calibishie Bay, nos. 67-582A, R-157. BARBADOS: St. Lucy Parish, River Bay, no. 67-811; Christ Church Parish, St. Lawrence Bay, no. 68-507. BEQUIA: Adams Beach, no. 66-371

————————, var. **solmsiana** (Falk.) W. R. Taylor:– ANTIGUA: St. George Parish, Judge Bay, no. 67-199A (on *Valonia*). BARBADOS: St. James Parish, Coral Reef Club area, no. 67-862 (*p.p.*, on *Valonia*).

AMPHIROA Lamouroux, 1812

A. fragilissima (L.) Lamx.:– GRAND CAYMAN: East End, Gun Bay, no. 67-62; South Shore, east of Boddentown near "Joe Conyers", no. 67-41. NEVIS: St. George Gingerland Parish, Indian Castle Estate, no. 68-250. ANTIGUA: St. John Parish, Wetherell Point, no. 66-484; Hodge Point, nos. 66-427, 67-171; St. George Parish, Judge Bay, nos. 67-189 (*p.p.*, with *Jania*), 67-190 (*p.p.*, with *Spyridia*). DOMINICA: St. Andrew Parish, Calibishie Bay, nos. 67-552, R-175; St. Mark Parish, no. 67-436. ST. LUCIA: Laborie Quarter, Laborie, no. 68-348. BARBADOS: St. Lucy Parish, River Bay, no. 66-90, Little Bay, nos. 66-55, 68-440; St. John Parish, Bath, no. 66-175. BEQUIA: Friendship Beach, no. 66-370. GRENADA: St. Georges Parish, Martins Bay, no. 66-294B.

A. rigida Lamx., var. **antillana** Børg.:– ANTIGUA: St. George Parish, Judge Bay, no. 67-187. DOMINICA: St. Andrew Parish, Calibishie Bay, no. 67-533.

A. tribulus (Soland.) Lamx.:– NEVIS: St. James Windward Parish, Sea Haven Estate, no. 68-224.

CORALLINA Linnaeus, 1858

C. cubensis (Mont.) Kütz.:– GRAND BAHAMA: West End, no. 68-16. GRAND CAYMAN: West Shore near West Bay Village, nos. 67-104 (*p.p.*, with *Coelothrix*), 67-105. DOMINICA: St. Paul Parish, 1.2 km. south of the Layou River, no. 67-731 (*p.p.*, with *Jania*). ST. LUCIA: Dauphin Quarter, Grand Anse Bay, no. 68-389. BARBADOS: St. Lucy Parish, River Bay, no. 67-693; St. John Parish, Bath Bay, no. 66-174.

C. subulata Soland.:– DOMINICA: St. Andrew Parish, Calibishie Bay, no. 67-585. ST. LUCIA: Castries Quarter, Grande Cul de Sac, no. 66-354 (*p.p.*, with *Jania*); Dauphin Quarter, Grand Anse, no. 68-369. BARBADOS: St. Lucy Parish, River Bay, nos. 66-81, 67-823; St. Andrew Parish, Chalky Mount, nos. 67-853, 68-487; St. John Parish, Bath Bay, no. 66-226.

JANIA Lamouroux, 1812

J. capillacea Harv.:– GRAND CAYMAN: West End near West Bay Village, no. 67-105 (*p.p.*, with *Corallina*). ST. KITTS: St. John Capisterre Parish, Black Rocks, no. GRP-A.3203. ANTIGUA: St. John Parish, St. John Harbor, 67-277. DOMINICA: St. Andrew Parish, Calibishie Bay, no. R-189A; St. Mark Parish, Soufrière Bay, no. 67-439. ST. LUCIA: Gros Islet Quarter, La Brellotte Bay, no. 68-316. BARBADOS: St. Lucy Parish, Little Bay, nos. 66-63, 68-440 (*p.p.*, with *Amphiroa*). GRENADA: St. Patrick Parish, Levera Beach, no. 66-288B.

J. adherens Lamx.:– GRAND BAHAMA: West End, no. 68-34. GRAND CAYMAN: West Shore near Pageant Beach Hotel, no. 67-84B, West Bay Village, no. 67-105 (*p.p.*, with *Corallina*). ANTIGUA: St. George Parish, Judge Bay, no. 67-189, 67-191. ST. LUCIA: Castries Quarter, Grande Cul de Sac, no. 68-354; Gros Islet Quarter, La Brellotte Bay, no. 68-304A. BARBADOS: St. John Parish, Bath Bay, no. 66-175B.

J. rubens (L.) Lamx.:– NEVIS: St. James Windward Parish, Sea Haven Estate no. 68-225. DOMINICA: St. Joseph Parish, 400 m. south of the Layou River, no. 67-335; St. Andrew Parish, Calibishie Bay, no. 67-550; St. Mark Parish, Soufrière Bay, nos. 67-432, R-260. ST. LUCIA: Gros Islet Quarter, La Brellotte Bay, no. 68-267, Jacks Beach, no. 68-414. BARBADOS: St. James Parish, Paynes Bay, no. 66-46B; St. Lucy Parish, River Bay, no. 66-85; St. John Parish, Bath Bay, no. 68-531 (*p.p.*, with *Avrainvillea*).

J. pumila Lamx.:– BARBADOS: Christ Church Parish, Silver Sands, no. 66-123 (*p.p.*, on *Dictyopteris*).

GRATELOUPIACEAE

HALYMENIA C. Agardh, 1817

H. agardhii De Toni:– BARBADOS: St. Lucy Parish, Little Bay, no. 68-829.

H. duchassaignianii (J. Agardh) Kylin:– GRENADA: St. George Parish, Point Salines, Black Bay, no. 66-270B; St. Andrew Parish, Marquis Bay, no. 66-278.

GRATELOUPIA C. Agardh, 1822

G. filicina (Wulf.) C. Agardh:– ST. KITTS: St. Peter Basseterre Parish, Conaree Beach, no. 68-41. NEVIS: St. Thomas Lowland Parish, Pinneys Beach, no. 68-145. ANTIGUA: St. John Parish, St. John Harbor, no. 67-275, Loblolly Bay, no. 67-294A. DOMINICA: St. George Parish, Roseau, no. 67-349; St. Paul Parish, 1.6-3.2 km. south of the Layou River, no. 67-327; St. Joseph Parish, 185 m. south of the Layou River, no. R-317, south of the Macoucherie River, no. 67-397; St. John Parish, Prince Rupert Bay, no. 67-489, Douglas Bay, nos. 67-493, 67-503; St. Andrew Parish, Woodford Hill Bay, no. R-252; St. David Parish, Rosalie, no. 67-461; St. Mark Parish, Soufrière Bay, no. R-275. ST. LUCIA: Gros Islet Quarter, La Brellotte Bay, no. 68-278. ST. VINCENT: St. George Parish, Argyle, no. 66-357; St. Patrick Parish, Barrouallie Beach, no. 66-321. GRENADA: St. Andrew Parish, Grenville Beach, no. 66-299.

G. cuneifolia J. Agardh:– DOMINICA: St. George Parish, Roseau, no. 67-350: St. Luke Parish, south of Pointe Michel, no. 67-420.

CRYPTONEMIA J. Agardh, 1842

C. luxurians (Mert.) J. Agardh:– NEVIS: St. Thomas Lowland Parish, Pinneys Beach, no. 68-142B; St. James Windward Parish, Mosquito Bay, no. 68-169A; Sea Haven Estate, no. 68-219. DOMINICA: St. David Parish, Rosalie, no. 67-450. BARBADOS: St. Andrew Parish, Chalky Mount, nos. 66-222, 68-485; St. John Parish, Bath Bay, no. 66-183. ST. VINCENT: St. George Parish, Calliaqua, no. 66-351. GRENADA: St. George Parish, Point Salines, Black Bay, no. 67-261; St. Patrick Parish, Levera Beach, no. 67-287B.

GIGARTINALES

GRACILARIACEAE

GRACILARIA Greville, 1830

G. verrucosa (Huds.) Papenf.:– NEVIS: St. Thomas Lowland Parish, Pinneys Beach, no. 68-129. DOMINICA: St. Paul Parish, 1.2 km. south of the Layou River, no. 67-367. ST. LUCIA: Castries Quarter, Grand Cul de Sac, no. 68-351. BARBADOS: St. Andrew Parish, Chalky Mount, no. 68-469; St. John Parish, Bath Bay, no. 66-180; Christ Church Parish, Oistins, nos. 66-102, 67-741; St. Michael Parish, Carlisle Bay, no. 67-765. ST. VINCENT: St. Andrew Parish, Camden Beach, nos. 66-329, 66-331.

G. debilis (Forssk.) Børg.:– ST. KITTS: St. George Basseterre Parish, North Friars Bay, no. GRP-A.3181; St. Peter Basseterre Parish, Conaree Beach, no. 68-52. NEVIS: St.

Thomas Lowland Parish, Pinneys Beach, no. 68-131; St. James Windward Parish, Sea Haven Estate, no. 68-218A; St. George Gingerland Parish, Indian Castle Estate, no. 68-239. DOMINICA: St. Andrew Parish, Calibishie Bay, no. 67-544, Woodford Hill Bay, Pointe La Soie, no. R-231. ST. LUCIA: Gros Islet Quarter, La Brellotte Bay, nos. 68-269, 68-323; Vieux Fort Quarter, Black Bay, no. 68-325. BARBADOS: St. Lucy Parish, River Bay, nos. 66-74, 67-826, 68-460; St. Andrew Parish, Chalky Mount, no. 68-482; Christ Church Parish, St. Lawrence Bay, no. 67-715. GRENADA: St. George Parish, Black Bay, no. 66-255, Grande Anse Beach, no. 66-316.

G. damaecornis J. Agardh:– NEVIS: St. Thomas Lowland Parish, Pinneys Beach, no. 68-132. DOMINICA: St. Paul Parish, 1.2 km. south of the Layou River, no. 67-370; St. Andrew Parish, Calibishie Bay, no. 67-554B. BARBADOS: St. Michael Parish, Gravesend, no. 67-780; St. Lucy Parish, River Bay, no. 66-79, 67-827; St. John Parish, Bath Bay, no. 67-663; Christ Church Parish, Oistins, nos. 66-109, 67-742.

G. crassissima Crouan:– ST. LUCIA: Castries Quarter, Grande Cul de Sac, no. 68-374. BARBADOS: St. Michael Parish, Gravesend, no. 67-700; St. Lucy Parish, River Bay, no. 67-824; Christ Church Parish, Oistins, no. 67-727B, Welches, no. 68-492, St. Lawrence Bay, no. 67-726. GRENADA: St. George Parish, Black Bay, no. 66-256.

G. ferox J. Agardh:– ST. KITTS: St. John Capisterre Parish, Dieppe Bay, no. 68-55. NEVIS: St. James Windward Parish, Sea Haven Estate, no. 68-212. DOMINICA: St. George Parish, Roseau, no. 67-352; St. Joseph Parish, Woodford Hill Bay, Pointe La Soie, nos. R-314, R-325. BARBADOS: St. Michael Parish, Gravesend, no. 67-778; St. Lucy Parish, River Bay, no. 67-825; Christ Church Parish, Oistins, nos. 66-107, 67-622, Welches, no. 68-494, St. Lawrence Bay, nos. 67-716, 68-494.

G. cervicornis (Turn.) J. Agardh:– ST. KITTS: St. Peter Basseterre Parish, Conaree Beach, no. 68-46, North Frigate Bay, no. 68-89. NEVIS: St. James Windward Parish, Mosquito Bay, no. 68-173. DOMINICA: St. Joseph Parish, Woodford Hill Bay, Pointe La Soie, no. R-314. ST. LUCIA: Castries Quarter, Grande Cul de Sac, no. 68-370. BARBADOS: St. Andrew Parish, Chalky Mount, no. 68-475; St. John Parish, Bath Bay, nos. 66-163A, 67-854, Conset Bay, no. 68-544; Christ Church Parish, Oistins, no. 67-620. ST. VINCENT: St. George Parish, Calliaqua, no. 66-343; St. Patrick Parish, Barrouallie, no. 66-324. BEQUIA: Adams Beach, nos. 66-384, 66-396.

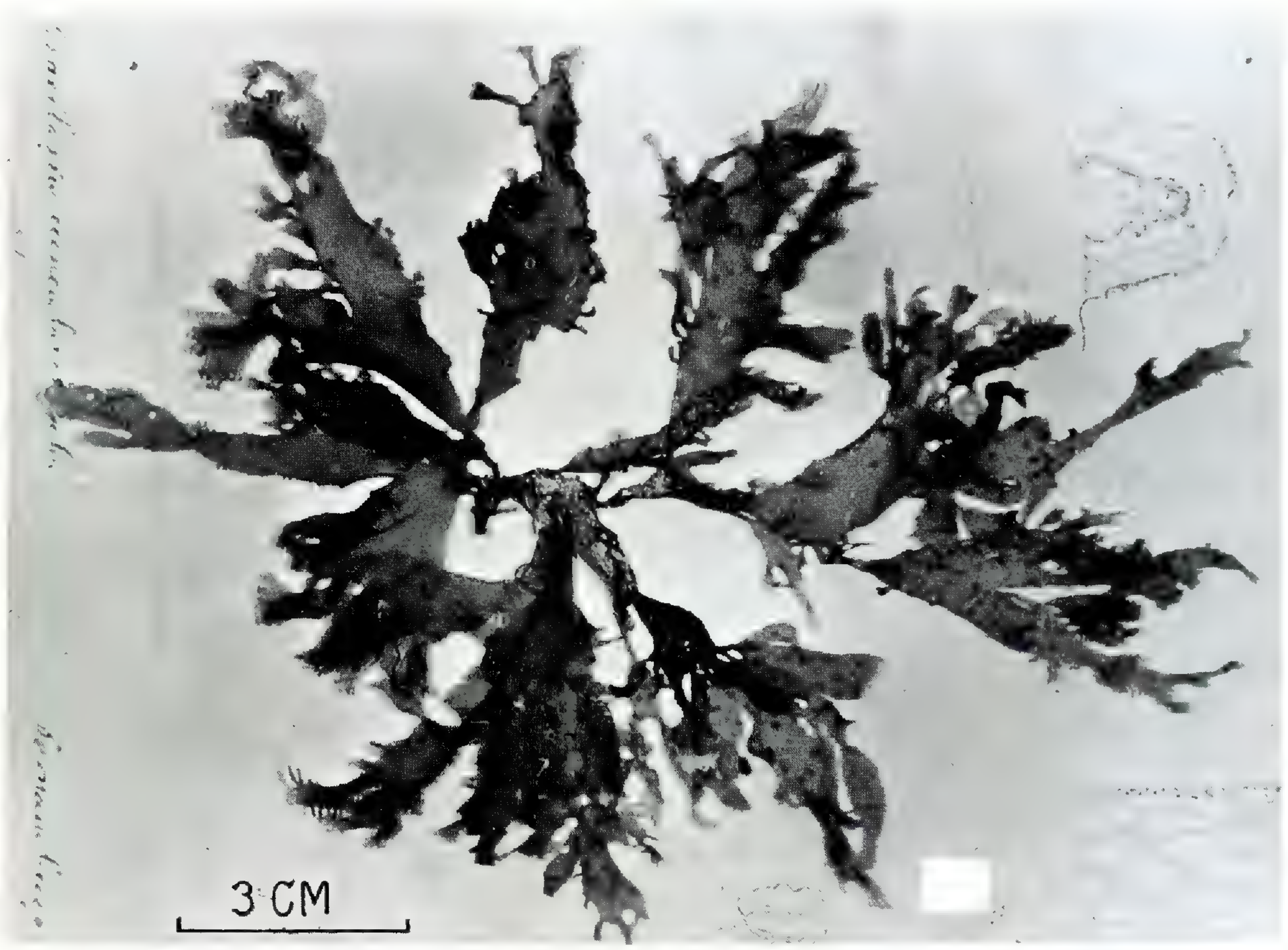
G. domingensis Sonder:– NEVIS: St. Thomas Lowland Parish, Pinneys Beach, no. 68-130. ANTIGUA: St. George Parish, Judge Bay, no. 67-178. DOMINICA: St. Paul Parish, 1.2 km. south of the Layou River, no. 67-374; St. Joseph Parish, 400 m. south of the Layou River, no. 67-342, a little south of the Layou River, no. 67-392, south of the Macoucherie River, no. 67-383; St. Andrew Parish, Calibishie Bay, no. R-178. ST. LUCIA: Castries Quarter, Grande Cul de Sac, no. 68-369. BARBADOS: St. Lucy Parish, River Bay, no. 66-73; Christ Church Parish, Oistins, no. 66-104. ST. VINCENT: St. Andrew Parish, Camden Beach, no. 66-330. GRENADA: St. George Parish, Point Salines, Black Bay, no. 66-266.

It is not unusual for a few ligulate proliferations to be found on the faces of the blades of this species, but these do not affect the general plane aspect of the branching.

G. cuneata Aresch.:– This species has not figured largely in the literature, and it appears that no particular specimen was marked as the type of the species when described (Areschoug 1855, p. 351). It seems appropriate to remedy this at this time, and the

one illustrated in Text-figure 25, Areschoug, Dec. 1844-Jan. 1845, from Pernambuco, Brazil, kindly loaned by the Naturhistoriska Riksmuseet, Sectionen för Botanik, Stockholm, Sweden, is designated lectotype. The broadly triangular primary blades, eventually forking at the distal end and marginally proliferous are characteristic. Crisping of the margin, mentioned in the early description, is not obvious. In our West Indian flora the nearest resemblance is to *G. curtissiae* J. Ag., which has much narrower blades.

NEVIS: St. James Windward Parish, Sea Haven Estate, no. 68-215. GRENADA: St. George Parish, Grand Anse Bay, no. 66-315, Point Salines, Black Bay, no. 66-254. BARBADOS: St. John Parish, Conset Bay, no. 68-539B.

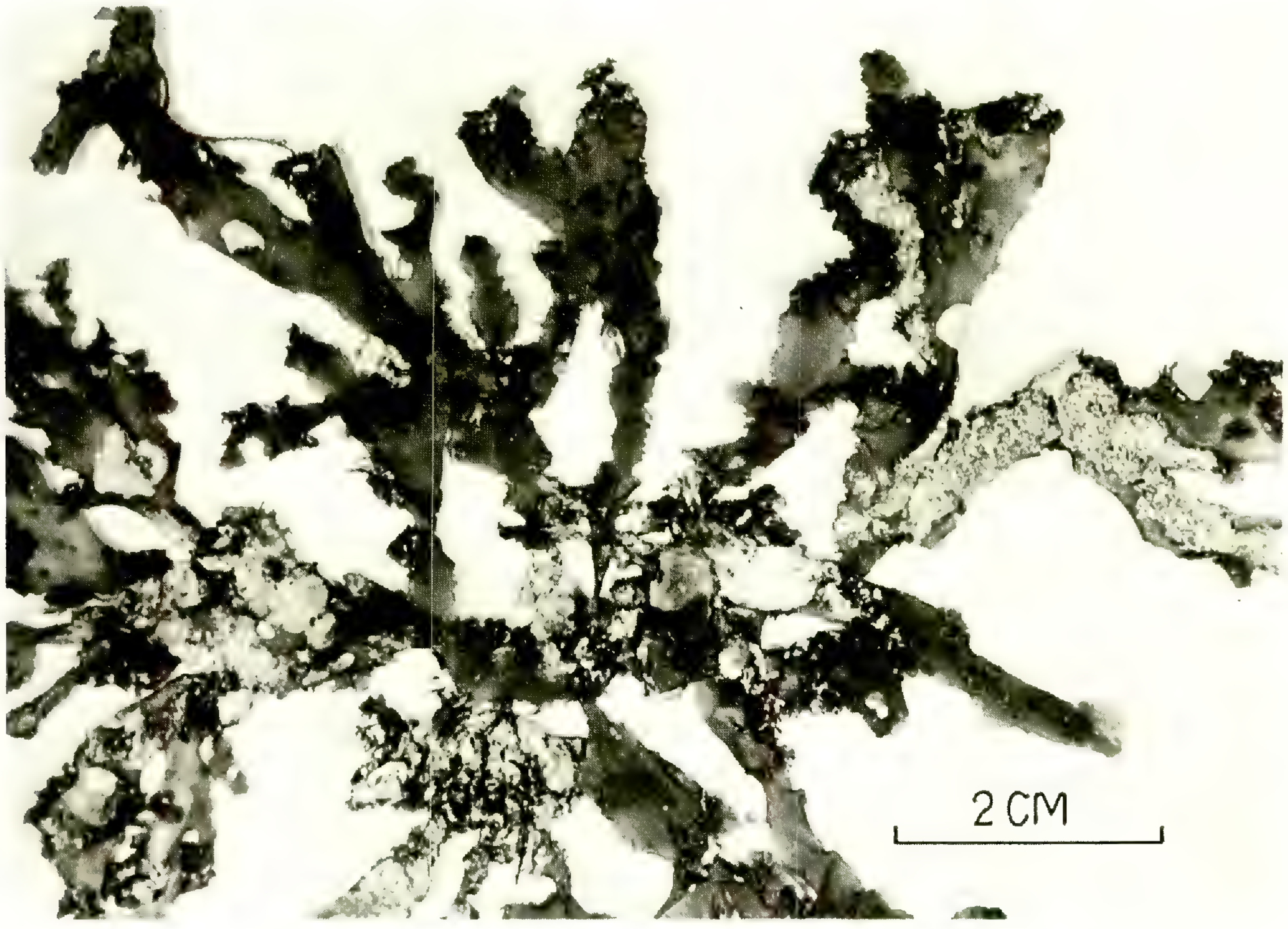


Text-figure 25. *Gracilaria cuneata* Aresch. Lectotype specimen in the Naturhistoriska Riskmuseet, Sectionen för Botanik, Stockholm. The broad segments with bases tapering, margins entire but proliferous, and distally furcate, are distinctive. Pernambuco, Brazil.

G. ornata Aresch.:– This species has been reported from St. Kitts, but nothing resembling the original plants from Brazil (kindly loaned by the Naturhistoriska Riksmuseet, Sectionen för Botanik) were found during our visit. These plants show strap-shaped branches with entire to locally erose or nearly ciliate-dentate margins, a feature hardly visible in the photographs as reproduced. Small blades are occasionally seen originating from the faces of the blades, and substellate outgrowths also. The structure corresponds to that of *Gracilaria,* and the cystocarps (see in other material) are in strongly projecting or stipitate outgrowths, forming the carpospores unilaterally about a sterile core. These features rule out *Callophyllis,* to which there is a superficial resemblance. As no specimen seems to have been designated the type of the species when described by Areschoug (1855, p. 351), his specimen from Pernambuco, Brazil in the Riksmuseet and illustrated in Text-figure 26 is designated the lectotype.

G. foliifera (Forssk.) Børg., var **foliifera**:– ANTIGUA: St. John Parish, St. John Harbor, no. 67-279. BARBADOS: Christ Church Parish, Oistins, no. 66-113, Hastings, no. 66-200. ST. VINCENT: St. Andrew Parish, Camden Beach, no. 66-333. GRENADA: St. Andrew Parish, Grenville Beach, no. 66-296.

————————, var. **angustissima** (Herv.) W. R. Taylor:– GRENADA: St. George Parish, Grand Mal Bay, no. 66-253; St. Andrew Parish, Grenville Beach, no. 66-297.



Text-figure 26. *Gracilaria ornata* Aresch. Lectotype specimen in the Riksmuseet. The blades are in general strap-shaped, as would have been more evident had it been practicable to soak up and rearrange the specimen for photography. The dentate margins hardly show in the print at this scale. Pernambuco, Brazil.

G. mammillaris (Mont.) Howe:– ANTIGUA: St. James Parish, Paynes Bay, no. 66-35. DOMINICA: St. Joseph Parish, south of the Macoucherie River, no. 67-415. BARBADOS: St. Peter Parish, Six Mens Bay, no. 67-800; Christ Church Parish, Oistins, nos. 67-743, 68-418. BEQUIA: Friendship Bay, no. 66-368.

G. sjostedii Kylin:– ST. KITTS: St. Peter Basseterre Parish, Conaree Beach, no. 68-36. ANTIGUA: St. John Parish, St. John Harbor, causeway to Rat Island, no. 67-269; St. Philip Parish, Exchange Bay, no. 66-458. DOMINICA: St. John Parish, Prince Rupert Bay, Portsmouth Harbor, S&W no. 27834. BARBADOS: St. Michael Parish, Needham Point, no. 67-702; St. John Parish, Bath, no. 68-532; Christ Church Parish, Oistins, nos. 66-101, 67-628, Hastings, no. 66-205. BEQUIA: Adams Beach, no. 66-395.

CORDYLECLADIA J. Agardh, 1852

C. peasiae Collins:– Plants growing in close colonies, the axes arising from a small, thin crust to a height of 5.0-7.5 cm., with a diameter reaching about 1.0-1.5 mm., the branching sparse, irregularly forking below or above somewhat cervicorn, and

throughout rather wiry in texture. Structurally showing a medulla of moderately large cells, somewhat smaller and with thicker walls outwardly, the surface layer of very small isodiammetric cells over a rather indistinct subcortex of 2-3 cell layers. The cells of the surface layer may develop outwardly in tiers of 4-7 thickening this tissue, but this is not everywhere present, nor could I find it in the type material. Collins (1901, p. 255) mentions very prominent cystocarps, but the structures which on my material seemed to fit turned out to be epiphytic foraminifera. The basal crust, which seems to be an important characteristic of the genus, is not present on the type material in the Farlow Herbarium. For the opportunity to examine this I am indebted to Prof. I. Mackenzie Lamb, the Curator. The type locality is Manchioneal, Jamaica, and isotype material is present in the Phyc. Bor.-Amer. as no. 791. BARBADOS: St. Andrew Parish, Chalky Mount area, on intertidal rocks, no. 58-468.

SOLIERIACEAE

AGARDHIELLA Schmitz, 1896

A. tenera (J. Agardh) Schmitz:– NEVIS: St. Thomas Lowland Parish, Pinneys Beach, no. 68-141. ANTIGUA: St. John Parish, causeway to Rat Island, no. 67-274. DOMINICA: St. Joseph Parish, south of the Macoucherie River, north of Mero, nos. 67-358, 67-416, just south of the river, no. 67-389; St. Paul Parish, south of the Layou River, no. 67-369. ST. VINCENT: St. George Parish, Calliaqua Bay, G. R. Proctor no. A.2596. BARBADOS: St. Michael Parish, Kensington, A. Vickers, Algues de la Barbade no. 123; St. Joseph Parish, Bathsheba, Vickers, *ibid.*, also called no. 123! GRENADA: St. Andrew Parish, Grenville Beach, no. 66-298.

As I have explained in a paper particularly dealing with Dominican algae (now in press) I long ago suspected that a West Indian plant called *A. tenera* was not the same alga as that which, coming from southern New England, has also passed under this name. The history of these plants is explained at length in that paper. In short, it appears that the West Indian plants have the best right to the name *tenera,* while that of *baileyi* is available for the northern specimens. The generic situation is unhappy, for Schmitz's generic definition seems to have been based on the northern specimens while *A. tenera* was designated the nomenclatural type. It is probable that the two so-called Agardhiellas do not belong to the same genus, or possibly the same family. Pending a fuller study of the cystocarp development of the tropical *A. tenera* a generic reallocation is held in abeyance.

EUCHEUMA J. Agardh, 1847

E. schrammii (Crouan) J. Agardh:– DOMINICA: St. Andrew Parish, Woodford Hill Bay, no. R-236.

E. echinocarpum Aresch.:– NEVIS: St. Thomas Lowland Parish, Pinneys Beach, no. 68-138; St. James Windward Parish, Mosquito Bay, no. 68-174. DOMINICA: St. Andrew Parish, Calibishie Bay, nos. 67-558, 67-575; St. Andrew Parish, Woodford Hill Bay, Pointe La Soie, no. R-235. The distinctions between this species and *E. gelidium* are by no means clear.

E. gelidium (J. Agardh) J. Agardh:– NEVIS: St. James Windward Parish, Sea Haven Estate, no. 58-216. ST. KITTS: St. Peter Basseterre Parish, North Frigate Bay, no. 68-77. BARBADOS: St. Michael Parish, Gravesend, no. 67-779; St. John Parish, Conset Bay, no. 68-543; Christ Church Parish, Oistins, nos. 67-619, 67-737, Welches, no. 68-495, St. Lawrence Bay, nos. 66-193, 67-717, Hastings, no. 66-204.

E. denticulatum (Burm. *f.*) Coll. & Herv.:– ANTIGUA: St. Paul Parish, Mamora Bay, no. 67-310. (*E. isiforme* in Taylor 1960; see Collins & Hervey 1917, p. 106 and Dixon 1962, p. 251).

MERISTOTHECA J. Agardh, 1872

M. floridana Kylin:– BARBADOS: Christ Church Parish, Oistins, no. 67-618.

RHABDONIACEAE

CATENELLA Greville, 1830

C. repens (Lightf.) Batt.:– GRAND BAHAMA: Settlement Point, no. 68-31.

While no special effort was made to search for this species, it is remarkable that it did not appear at other stations in 1966-68. Doubtless the scarcity of mangrove areas visited is partly responsible, but the species is not restricted to them.

HYPNEACEAE

HYPNEA Lamouroux, 1813

H. spinella (C. Agardh) Kütz.:– NEVIS: St. Thomas Lowland Parish, Pinneys Beach, no. 68-147B; St. George Gingerland Parish, Indian Castle Estate, no. 68-245. ANTIGUA: St. Paul Parish, Crawle Bay, no. 67-221. DOMINICA: St. Joseph Parish, south of the Macoucherie River, no. 67-402. BARBADOS: St. Peter Parish, Heywoods Beach, no. 68-426; St. John Parish, Bath Bay, no. 67-669. BEQUIA: Adams Beach, no. 66-393.

H. cervicornis J. Agardh:– GRAND CAYMAN: South Shore east of Boddentown on *Thalassia* flats near "Joe Conyers", no. 67-28. ANTIGUA: St. John Parish, St. John Harbor, no. 67-272, Hodge Point, no. 66-419C. BARBADOS: St. James Parish, Paynes Bay, no. 66-37. GRENADA: St. Andrew Parish, Grenville Beach, no. 66-303.

H. musciformis (Wulf.) Lamx.:– GRAND CAYMAN: North Shore, Grape Tree Point, no. GRP-A.2188; East End, Gun Bay, no. 67-55. ST. KITTS: St. John Capisterre Parish, Dieppe Bay, no. 68-59B. NEVIS: St. James Windward Parish, Sea Haven Estate, no. 68-218B. ANTIGUA: St. John Parish, Soldiers Bay, no. 67-153, Port Royal Bay, no. 66-491, Hodge Point, no. 66-446; St. George Parish, Judge Bay, no. 66-466; St. Paul Parish, Crawle Bay, no. 67-211. DOMINICA: St. Joseph Parish, 400 m. south of the Layou River, no. 67-345, south of the Macoucherie River, no. 67-399; St. John Parish, Prince Rupert Bay, no. 67-470; St. Andrew Parish, Woodford Hill Bay, nos. R-211, R-256A. ST. LUCIA: Castries Quarter, Grande Cul de Sac, no. 68-372; Gros Islet Quarter, La Brellotte Bay, no. 68-263; Laborie Quarter, Laborie, no. 68-344B. BARBADOS: St. Michael Parish, Needham Point, no. 67-703; St. James Parish, Paynes Bay, no. 68-560; St. Peter Parish, Heywoods Beach, no. 68-430, Six Mens Bay, no. 66-645; St. Lucy Parish, River Bay, nos. 66-67, 67-648; St. Joseph Parish, Cattle Wash, no. 66-4; Christ Church Parish, Rockley Beach, no. 67-708A, Hastings, no. 66-202. ST. VINCENT: St. Patrick Parish, Barrouallie Beach, no. 66-327. BEQUIA: Adams Beach, no. 66-392. GRENADA: St. George Parish, Grand Mal Bay, no. 66-251.

PHYLLOPHORACEAE

GYMNOGONGRUS Martius, 1828

G. tenuis (J. Agardh) J. Agardh:– NEVIS: St. Thomas Lowland Parish, Pinneys Beach, no. 68-147A. DOMINICA: St. George Parish, Roseau, no. 67-351; St. Paul Parish, 1.6-3.2 km. south of the Layou River, no. 67-326; St. Joseph Parish, south of the Macoucherie River, nos. 67-380C, 67-404. St. John Parish, Douglas Bay, no. 67-494; St. Mark Parish, Soufrière Bay, no. R-283. ST. LUCIA: Gros Islet Quarter, La Brellotte Bay, no. 68-280. BARBADOS: St. Michael Parish, Bridgetown at "Pelican Village", no 67-755; Christ Church Parish, Silver Sands, no. 66-129. ST. VINCENT: St. Patrick Parish, Barrouallie Beach, no. 66-322.

RHODYMENIACEAE

BOTRYOCLADIA Kylin, 1931

B. pyriformis (Børg.) Kylin:– BARBADOS: St. James Parish, from 60-70 m. depth off Miramar Hotel near Holetown, no. 66-138.

B. occidentalis (Børg.) Kylin:– DOMINICA: St. Andrew Parish, Calibishie Bay, no. R-193. BARBADOS: St. Lucy Parish, River Bay, no. 67-830; St. John Parish, Bath Bay, no. 66-149, 67-664, Conset Bay, no. 66-211, 68-537. GRENADA: St. George Parish, Point Salines, Black Bay, no. 66-260; St. Andrew Parish, Marquis Beach, no. 66-271.

CHAMPIACEAE

LOMENTARIA Lyngbye, 1819

L. baileyana (Harv.) Farl.:– BARBADOS: St. Michael Parish, Gravesend, no. 67-777.

COELOTHRIX Børgesen, 1920

C. irregularis (Harv.) Børg.:– GRAND CAYMAN: West Bay Village, no. 67-104. ANTIGUA: St. John Parish, Hodge Point, no. 66-419B, 67-135. DOMINICA: St. George Parish, Roseau, no. 67-354. ST. LUCIA: Laborie Quarter, Laborie, no. 68-346. BARBADOS: St. James Parish, at 2.5 m. depth off the Coral Reef Club near Holetown, no. 67-751, at 8 m. depth off the Colony Club near Holetown, no. 66-11A; St. Peter Parish, Six Mens Bay, no. 67-798; St. John Parish, Conset Bay, no. 66-218.

CHAMPIA Desvaux, 1808

C. parvula (C. Agardh) Harv.:– NEVIS: St. Thomas Lowland Parish, Pinneys Beach, no. 68-147B (*p.p.*, with *Hypnea*). ANTIGUA: St. George Parish, Judge Bay, no. 67-175B; St. Paul Parish, Crawle Bay, no. 67-223. DOMINICA: St. Andrew Parish, Woodford Hill Bay, no. R-237A. BARBADOS: St. Michael Parish, Gravesend, no. 67-775.

CERAMIALES

CERAMIACEAE

CROUANIA J. Agardh, 1842

C. attenuata (C. Agardh) J. Agardh:– ANTIGUA: St. George Parish, Judge Bay, no. 67-174; St. Paul Parish, Crawle Bay, no. 67-208 (*p.p.*, with *Dohrniella*).

DOHRNIELLA Funk, 1922

D. antillarum (W. R. Taylor) Feldm.-Maz.:– ANTIGUA: St. John Parish, Port Royal Bay, no. 66-492; St. George Parish, Judge Bay, no. 67-164 (*p.p.*, with *Chondria*), no. 67-166 (*p.p.*, with *Callithamnion*); St. Paul Parish, Crawle Bay, no. 67-208 (on *Cymodocea*).

WRANGELIA C. Agardh, 1828

W. argus Mont.:– ST. KITTS: St. John Capisterre Parish, Black Rocks, no. 68-122A. NEVIS: St. Thomas Lowland Parish, Pinneys Beach, no. 68-122B. DOMINICA: St. John Parish, Douglas Bay near Tanetane village, no. 67-497; St. Mark Parish, Soufrière Bay, no. 67-424, R-304; St. Luke Parish, 0.8-1.2 km. south of Pointe Michel, no. 67-419. ST. LUCIA: Gros Islet Quarter, La Brellotte Bay, nos. 68-261, 68-314. BARBADOS: St. James Parish, Paynes Bay, no. 68-652; off Coral Reef Club near Holetown, nos. 66-12, 67-748 (at 2.5 m. depth), 67-790; St. Peter Parish, Heywood Beach, no. 68-427, Six Mens Bay, no. 67-643.

W. biscuspidata Børg.:– GRAND CAYMAN: West Shore near West Indian Club, no. 67-9. ST. LUCIA: Gros Islet Quarter, La Brellotte Bay, no. 68-287. BARBADOS: St. James Parish, off Coral Reef Club near Holetown, no. 67-790; Christ Church Parish, Oistins, no. 67-612.

W. penicillata C. Agardh:– GRAND CAYMAN: West Shore, near West Indian Club, no. 67-4. NEVIS: St. Thomas Lowland Parish, Pinneys Beach, no. 68-126. BARBADOS: St. Andrew Parish, Chalky Mount, no. 67-848; St. John Parish, Conset Bay, no. 66-221.

CALLITHAMNION Lyngbye, 1819

C. cordatum Børg.:– ANTIGUA: St. George Parish, Judge Bay, no. 67-166.

HALOPLEGMA Montagne, 1842

H. duperreyi Mont.:– NEVIS: St. James Windward Parish, Sea Haven Estate, no. 68-204. BARBADOS: St. Lucy Parish, River Bay, no. 67-808, Little Bay, no. 67-832; St. Andrew Parish, Chalky Mount, no. 68-486; St. John Parish, Bath Bay, nos. 66-144, 67-857, Conset Bay, nos. 66-217, 68-535. GRENADA: St. George Parish, Salines Point, Black Bay, no. 66-262.

GRIFFITHSIA C. Agardh, 1817

G. schousboei Mont. (?):– GRAND CAYMAN: West Shore, near West Indian Club, no. 67-8.

G. tenuis C. Agardh:– ST. LUCIA: Vieux Fort Quarter, Anse des Sables, no. 68-333. BARBADOS: Christ Church Parish, Oistins, nos. 66-115, 67-731, Silver Sands, no. 66-129.

CERAMIUM Roth, 1797

C. fastigiatum (Roth) Harv. (?):– BARBADOS: Christ Church Parish, Oistins, nos. 66-115, 67-610.

C. brevizonatum Peters., var. **caraibica** Peters. & Børg.:– ANTIGUA: St. John Parish, Soldiers Bay, no. 67-150. BARBADOS: St. Michael Parish, Carlisle Bay, no. 67-758; Christ Church Parish, Oistins, no. 67-608.

C. subtile J. Agardh:– DOMINICA: St. Andrew Parish, Calibishie Bay, no. 67-571(?). BARBADOS: Christ Church Parish, Oistins, nos. 66-116, 67-609.

C. byssoideum Harv.(?):– BARBADOS: Christ Church Parish, Oistins, no. 67-609.

C. corniculatum Mont.:– BARBADOS: St. Peter Parish, Six Mens Bay, nos. 66-18, 67-642.

C. tenuissimum (Lyngb.) J. Agardh:– BARBADOS: St. Michael Parish, Carlisle Bay, no. 67-758; Christ Church Parish, Oistins, nos. 67-608, 67-610.

C. nitens (C. Agardh) J. Agardh:– GRAND CAYMAN: West Shore, near West Indian Club, no. 67-2. ST. KITTS: St. George Basseterre Parish, Frigate Bay, no. 68-119; St. John Capisterre Parish, Dieppe Bay, no. 67-53. DOMINICA: St. Paul Parish, 1.2 km. south of the Layou River, no. 67-361; St. Joseph Parish, south of the Macoucherie River, no. 67-384; St. Andrew Parish, Calibishie Bay, no. R-190; St. Mark Parish, Scotts Head on the Atlantic side, no R-296. BARBADOS: St. James Parish, off the Coral Reef Club area, near Holetown at 21 m. depth, no. 67-750, off the Colony Club near Holetown, at 8 m. depth, no. 66-11B.

CENTROCERAS Kützing, 1842

C. clavulatum (C. Agardh) Mont.:– GRAND CAYMAN: West Shore, near West Indian Club, no. 67-13A; North Sound, Botabano, no. GRP-A.2506; East End, Gun Bay, no. 67-56; South Shore, Boddentown, no. 67-46. ST. KITTS: St. John Capisterre Parish, Black Rocks, no. GRP-A.3207, 68-122C. ANTIGUA: St. John Parish, mangrove swamp behind Pinchin Bay, no. 67-284B; St. John Harbor, causeway to Rat Island, no. 67-278; Hodge Point, nos. 66-444, 67-135; St. Philip Parish, Fanneys Cove, no. 67-247; St. Paul Parish, Crawle Bay, no. 67-217, Mamora Bay, no. 67-311. DOMINICA: St. Paul Parish, 1.2 km. south of the Layou River, no. 67-361; St. Joseph Parish, 400 m. south of the Layou River, no. 67-341; St. Andrew Parish, Calibishie Bay, no. 67-586, Woodford Hill Bay, Pointe La Soie, nos. R-206, R-221; St. Mark Parish, Soufrière Bay, no. 67-439A. ST. LUCIA: Castries Quarter, Castries Harbor, no. 68-402, Gros Islet Quarter, Jack Beach, no. 68-413B; Laborie Quarter, Laborie, no. 68-336. BARBADOS: St. Peter Parish, Six Mens Bay, nos. 66-22, 67-649; St. Lucy Parish, River Bay, no. 67-688, Little Bay, no. 68-444; Christ Church Parish, Oistins, no. 67-614A. ST. VINCENT: St. Patrick Parish, Barrouallie Bay, no. 66-326A. BEQUIA: Adams Beach, no. 66-379A, Friendship Beach, no. 66-369B.

SPYRIDIA Harvey, 1833

S. filamentosa (Wulf.) Harv.:– GRAND CAYMAN: West Shore near Pageant Beach Club, no. 67-79, near West Indian Club, no. 67-10; North Sound, Botabano, no. GRP-A.2503; South Shore, Red Bay, no. 67-111. ANTIGUA: St. John Parish, mangrove swamp behind Pinchin Bay, no. 67-284A; St. George Parish, Judge Bay, no. 67-190; St. Paul Parish, Crawle Bay, no. 67-216. ST. LUCIA: Castries Quarter, Grande Cul de Sac, no. 68-371, Castries Harbor, no. 68-403; Gros Islet Quarter, La Brellotte Bay, no. 68-285. BARBADOS: St. Lucy Parish, Little Bay, no. 67-835; Christ Church Parish, Oistins, no. 66-110.

S. clavata Kütz.:– BARBADOS: Christ Church Parish, Oistins, no. 67-607.

S. aculeata (Schimp.) Kütz., var. **aculeata**:– ST. KITTS: St. Peter Basseterre Parish, North Frigate Bay, no. 68-80. DOMINICA: St. Joseph Parish, south of the Macoucherie River, no. 67-406; St. Andrew Parish, Woodford Hill Bay, Pointe La Soie, no. R-212. ST. LUCIA: Castries Quarter, La Toc Bay, no. 68-413A. BARBADOS: St. John Parish, Bath Bay, no. 66-190.

————————, var. **disticha** Børg.:– BARBADOS: Christ Church Parish, Oistins, no. 67-611.

————————, var. **hypneoides** J. Agardh:– GRAND CAYMAN: West Shore near Pageant Beach Hotel, no. 67-90. NEVIS: St. George Gingerland Parish, Indian Castle Estate, no. 68-236. ANTIGUA: St. John Parish, Port Royal Bay, no. 66-493; St. George Parish, Judge Bay, no. 67-165.

DELESSERIACEAE

CALOGLOSSA (Harvey) J. Agardh, 1876

C. leprieurii (Mont.) J. Agardh:– GRENADA: St. George Parish, Lower Woburn, no. 66-312. The remarks regarding *Catenella* apply here also.

TAENIOMA J. Agardh, 1863

T. nanum (Kütz.) Papenf.:– CUBA: Camagüey Prov., Tarifa, E. Y. Dawson no. 7613 (= *T. perpusillum* Phyc. Bor.-Amer. no. 1935 from Bermuda, *non* J. Agardh; as *T. macrourum* Thuret in Taylor 1960 p. 548).

MARTENSIA Hering, 1841

M. pavonia (J. Agardh) J. Agardh:– ANTIGUA: St. George Parish, Judge Bay, no. 67-162. BARBADOS: St. James Parish, 8 m. depth off the Colony Club, near Holetown, no. 66-10 (coll. J. B. Lewis).

DASYACEAE

DASYA C. Agardh, 1824

D. rigidula (Kütz.) Ardis.:– GRAND CAYMAN: West Shore near West Indian Club, no. 67-3; North Sound near Botabano, no. GRP-A.2507. ANTIGUA: St. George Parish, Judge Bay, nos. 67-170, 67-185; St. Paul Parish, Crawle Bay, no. 67-213. ST. LUCIA: Gros Islet Quarter, La Brellotte Bay, no. 68-378.

D. collinsiana Howe:– BAHAMAS: Grand Bahama I., West End, occasional large tufts on the shoal behind the hotel, no. 68-8. GRAND CAYMAN: West Shore near West Indian Club, no. 67-3. ANTIGUA: St. George Parish, Judge Bay, nos. 67-163B, 67-169.

Plants here, and in Florida, may reach a height of over 5 cm.

D. sertularioides Howe & Taylor:– JAMAICA: Kingston Parish, Palisadoes, no. GRP-A.4852.

This represents a notable extension of range for the species, Brazil being the type locality.

D. ramosissima Harv.:– ANTIGUA: St. John Parish, Soldiers Bay, no. 67-149.

D. pedicellata (C. Agardh) C. Agardh:– GRAND CAYMAN: North Sound, Georgetown Embarcadero, no. 67-121. NEVIS: St. James Windward Parish, Mosquito Bay, no. 68-172. BARBADOS: Christ Church Parish, Oistins, no. 67-601.

HETEROSIPHONIA Montagne, 1842

H. wurdemanni (Bail. *ex* Harv.) Falk.:– ANTIGUA: St. Paul Parish, Crawle Bay, no. 67-213. BARBADOS: Christ Church Parish, Oistins, no. 67-734.

H. gibbesii (Harv.) Falk.:– ST. KITTS: St. George Basseterre Parish, North Friars Bay, no. GRP-A.3183; St. Peter Basseterre Parish, North Frigate Bay, no. 68-78,

HALODICTYON Zanardini, 1843

H. mirabile Zan.:– BARBADOS: St. Lucy Parish, River Bay, no. 67-686B.

RHODODICTYON W. R. Taylor, 1961

R. bermudensis W. R. Taylor:– BARBADOS: St. James Parish, from 60-70 m. depth off the Miramar Hotel near Holetown, no. 66-142.

DICTYURUS Bory, 1836

D. occidentalis J. Agardh:– BARBADOS: St. Lucy Parish, River Bay, no. 66-71; St. Andrew Parish, Chalky Mount, no. 68-477.

THURETIA Decaisne, 1843

T. bornetii Vick.:– BARBADOS: St. Lucy Parish, River Bay, nos. 66-70, 67-686A.

RHODOMELACEAE

FALKENBERGIA Schmitz, 1897

F. hillebrandii (Born.) Falk.:– GRAND CAYMAN: North Sound, Botabano, no. GRP-A.2512. ANTIGUA: St. John Parish, Soldiers Bay, no. 67-151, Hodge Point, no. 67-237; St. George Parish, Judge Bay, no. 67-168. DOMINICA: St. Andrew Parish, Calibishie Bay, no. 67-528.

POLYSIPHONIA Greville, 1824

P. subtilissima Mont.:– ST. KITTS: St. Peter Basseterre Parish, Conaree Beach, no. GRP-A.3152. ANTIGUA: St. John Parish, Loblolly Bay, no. 67-293B, St. John Harbor, no. 67-280.

P. sphaerocarpa Børg.:– ANTIGUA: St. John Parish, Loblolly Bay, no. 67-295A. DOMINICA: St. Joseph Parish, south of the Macoucherie River, no. 67-403; St. Mark Parish, Soufrière Bay, no. 67-427 (both det. by G. W. Hollenberg). BARBADOS: St. James Parish, off Coral Reef Club near Holetown, no. 67-745.

P. binneyi Harv.:– ANTIGUA: St. John Parish, Loblolly Bay, no. 67-295 (?); St. Paul Parish, Crawle Bay, no. 67-228 (?). DOMINICA: St. Joseph Parish, south of the Macoucherie River, no. 67-400.

P. ferulacea Suhr:– GRAND CAYMAN: East End, Old Isaacs, no. GRP-25 IV 56. ST. KITTS: St. George Basseterre Parish, South Friars Bay, no. GRP-A.3177; St. Peter Basseterre Parish, Conaree Beach, no. GRP-A.3119. ANTIGUA: St. John Parish, Hodge Point, nos. 66-437, 66-445. DOMINICA: St. Andrew Parish, near the mouth of the Woodford Hill River, nos. R-244, R-249 (det. G. W. Hollenberg). BARBADOS: St. Peter Parish, Six Mens Bay, no. 66-23 (det. G. W. Hollenberg); St. Joseph Parish, Cattle Wash, no. 66-5; Christ Church Parish, Oistins, no. 67-613.

P. denudata (Dillw.) Kütz.:– BARBADOS: Christ Church Parish, Oistins, no. 67-613.

P. howei Hollenb.:– BAHAMAS: Grand Bahama I., West End, Settlement Point, no. 68-2. ST. KITTS: St. George Basseterre Parish, Frigate Bay, no. 68-113A. ANTIGUA: St. John Parish, Hodge Point, nos. 66-408, 67-103. ST. LUCIA: Gros

Islet Quarter, La Brellotte Bay, no. 68-304C. BARBADOS: St. Lucy Parish, Fryer Well Point, no. 66-14.

BRYOCLADIA Schmitz, 1897

B. thyrsigera (J. Agardh) Schmitz:– DOMINICA: St. Andrew Parish, Woodford Hill Bay, nos. R-222, R-245; St. David Parish, Rosalie, no. 67-459.

B. cuspidata (J. Agardh) DeToni:– DOMINICA: St. Andrew Parish, Woodford Hill Bay, no. R-251. BARBADOS: St. Andrew Parish, Chalky Mount, no. 66-478; St. John Parish, Bath Bay, no. 66-143A, Conset Bay, no. 68-549.

BRYOTHAMNION Kützing, 1843

B. seaforthii (Turn.) Kütz.:– ST. KITTS: St. Peter Basseterre Parish, Conaree Beach, no. GRP-A.3130. NEVIS: St. George Gingerland Parish, Red Cliff, no. GRP-A.3211. DOMINICA: St. Andrew Parish, Calibishie Bay, no. 67-574, Woodford Hill Bay, nos. R-210, R-230B. ST. LUCIA: Dauphin Quarter, Grand Anse Beach, no. 68-372. BARBADOS: St. Lucy Parish, River Bay, nos. 66-78, 67-815; St. John Parish, Bath Bay, no. 67-659; Christ Church Parish, Oistins, nos. 66-106, 67-603, 67-740, St. Lawrence Bay, nos. 66-194, 67-718. ST. VINCENT: Charlotte Parish, Peruvian Vale, no. 66-354. GRENADA: St. George Parish, Point Salines, Black Bay, no. 66-264.

B. triquetrum (Gmel.) Howe:– GRAND CAYMAN: West Shore, near Pageant Beach Hotel, no. 67-88. ST. KITTS: St. John Capisterre Parish, Dieppe Bay, no. 68-66; St. Peter Basseterre Parish, Conaree Beach, no. 68-42. NEVIS: St. Thomas Lowland Parish, Pinneys Beach, no. 68-146; St. James Windward Parish, Sea Haven Estate, no. 68-221. ANTIGUA: St. John Parish, Loblolly Bay, no. 67-287. DOMINICA: St. Joseph Parish, 185 m. south of the Layou River, no. R-316; St. Andrew Parish, Calibishie Bay, nos. 67-539, R-177. ST. LUCIA: Castries Quarter, Grande Cul de Sac, no. 68-375; Gros Islet Quarter, La Brellotte Bay, no. 68-310. BARBADOS: St. James Parish, Paynes Bay, no. 66-41; St. Lucy Parish, River Bay, no. 67-461; St. John Parish, Bath Bay, no. 67-658, Conset Bay, no. 68-547; Christ Church Parish, Oistins, no. 67-637, St. Lawrence Bay, no. 67-724. GRENADA: St. Andrew Parish, Marquis Beach, no. 66-273.

In Solander's paper (1786, pl. 26, fig. 1) there is what appears to be a good illustration of *B. triquetrum*, but is is not identified in the text.

DIGENIA C. Agardh, 1863

D. simplex (Wulf.) C. Agardh:– GRAND CAYMAN: West Shore, near Pageant Beach Hotel, no. 67-118. ST. KITTS: St. George Basseterre Parish, Frigate Bay, no. 68-107; St. Peter Basseterre Parish, Conaree Bay, nos. 67-48B, 67-51. NEVIS: St. James Windward Parish, Mosquito Bay, no. 68-167, Sea Haven Estate, no. 68-207B. ANTIGUA: St. John Parish, Soldier Bay, no. 67-152, Hodge Point, no. 67-137. DOMINICA: St. Andrew Parish, Calibishie Bay, no. 68-549, R-192. ST. LUCIA: Gros Islet Quarter, La Brellotte Bay, no. 68-321. BARBADOS: St. Michael Parish, Needham Point, no. 67-699; St. Lucy Parish, River Bay, no. 66-87, Wickes Bay, no. 67-674B, Little Bay, no. 66-57, 67-843; St. John Parish, Bath Bay, no. 67-661; Christ Church Parish, Hastings, no. 66-206. BEQUIA: Adams Beach, no. 66-383. GRENADA: St. Patrick Parish, Levera Beach, no. 66-288A.

LOPHOCLADIA Schmitz, 1893

L. trichoclados (Mert.) Schmitz:– NEVIS: St. Thomas Lowland Parish, Pinneys Beach,

no. 68-123; St. James Windward Parish, Mosquito Bay, no. 68-171.

MURRAYELLA Schmitz, 1893

M. periclados (C. Agardh) Schmitz:– GRAND CAYMAN: West Shore, West Point, no. 67-107; North Sound, Botabano, no. GRP-A.2505; South Shore, Red Bay, no. 67-111. ANTIGUA: St. Paul Parish, Mamora Bay, no. 67-314. GRENADA: St. George Parish, Lower Woburn, no. 66-311.

BOSTRYCHIA Montagne, 1842

B. rivularis Harv.:– ANTIGUA: St. Philip Parish, Fanneys Cove, no. 67-250. DOMINICA: St. Andrew Parish, Woodford Hill River about 185 m. from the bay, no. R-248.

B. moritziana (Sond.) J. Agardh:– ANTIGUA: St. Paul Parish, Mamora Bay, on mangroves, no. 67-315.

B. binderi Harv.:– JAMAICA: Clarendon Parish, Holmes Bay, no. 56-454; Hanover Parish, Lucea, no. 56-633; St. James Parish, Long Bay, no. 56-571; St. Ann Parish, Priory, no. 56-46. ST. KITTS: St. John Capisterre Parish, Black Rocks, no. 68-120A. ANTIGUA: St. John Parish, Hodge Point, no. 67-241.

B. tenella (Vahl) J. Agardh:– GRAND BAHAMA: West End, Settlement Point, no. 68-1. ANTIGUA: St. Philip Parish, Fanneys Cove, no. 67-249. BARBADOS: St. Lucy Parish, River Bay, no. 66-86, Little Bay, no. 66-50. BEQUIA: Adams Beach, no. 66-380.

HERPOSIPHONIA Nägeli, 1846

H. secunda (C. Agardh) Ambronn:– NEVIS: St. Thomas Lowland Parish, Pinneys Beach, no. 68-141 (*p.p.*, with *Agardhiella*). ANTIGUA: St. George Parish, Judge Bay, no. 67-164 (*p.p.*, with *Chondria*). DOMINICA: St. Mark Parish, Soufrière Bay, no. R-307A.

H. tenella (C. Agardh) Ambronn:– BARBADOS: St. Lucy Parish, Wickes Bay, no. 67-164.

LOPHOSIPHONIA Falkenberg, 1897

L. subadunca (Kütz.) Falk.:– GRAND CAYMAN: West Shore near West Indian Club, no. 67-13B.

L. cristata Falk.:– GRAND CAYMAN: West Shore, near Pageant Beach Hotel, no. 67-98(?). ANTIGUA: St. John Parish, Loblolly Bay, nos. 67-292, 67-300, Hodge Point, no. 67-140.

AMANSIA Lamouroux, 1809

A. multifida Lamx.:– NEVIS: St. James Windward Parish, Sea Haven Estate, no. 68-208B; St. George Gingerland Parish, Indian Castle Estate, no. 68-231. DOMINICA: St. Andrew Parish, Calibishie Bay, no. 67-556, Woodford Hill Estate, Pointe la Soie, no. R-230A. GRENADA: Charlotte Parish, Peruvian Vale, no. 66-347.

VIDALIA Lamouroux, 1824

V. obtusiloba (Mert.) J. Agardh:– NEVIS: St. Thomas Lowland Parish, Pinneys Beach, no. 68-142, Jones Bay, no. 68-155; St. James Windward Parish, Mosquito Bay, no. 68-168, Sea Haven Estate, no. 68-220; St. George Gingerland Parish, Indian Castle

Estate, no. 68-232. DOMINICA: St. Andrew Parish, Calibishie Bay, no. 67-582. ST. VINCENT: Charlotte Parish, Peruvian Vale, no. 66-353. GRENADA: St. George Parish, Point Salines, Black Bay, no. 66-263.

ENANTIOCLADIA Falkenberg, 1889

E. duperreyi (C. Agardh) Falk.:— ST. KITTS: St. Peter Basseterre Parish, North Frigate Bay, no. 68-75. NEVIS: St. Thomas Lowland Parish, Pinneys Beach, no. 68-133, Jones Bay, no. 68-156; St. George Gingerland Parish, Indian Castle Estate, no. 68-244. DOMINICA: St. George Parish, Roseau, no. 67-359; St. Joseph Parish, south of the Macoucherie River, nos. R-308, 67-382. GRENADA: St. Patrick Parish, Levera Beach, no. 66-287A.

CHONDRIA C. Agardh, 1817

C. littoralis Harv.:— ST. KITTS: St. Peter Basseterre Parish, Conaree Beach, no. 68-35, North Frigate Bay, no. 68-70. ANTIGUA: St. John Parish, Hodge Point, nos. 66-440, 67-138; St. George Parish, Judge Bay, no. 67-164. DOMINICA: St. Joseph Parish, 185 m. and 400 m. south of the Layou River, nos. R-315, 67-346, south of the Macoucherie River, no. 67-391.

C. atropurpurea Harv.:— GRENADA: St. Andrew Parish, Grenville Beach, no. 66-282.

C. sedifolia Harv.:— ANTIGUA: St. George Parish, Judge Bay, no. 67-159, 67-173.

C. curvilineata Coll. & Herv.:— ANTIGUA: St. George Parish, Judge Bay, no. 67-175.

ACANTHOPHORA Lamouroux, 1813

A. muscoides (L.) Børg.:— ANTIGUA: St. Paul Parish, Crawle Bay, no. 67-222. DOMINICA: St. Paul Parish, between Layou and Goodwill, no. S&W-27843. BARBADOS: St. Peter Parish, Six Mens Bay, no. 66-20; St. Lucy Parish, Little Bay, no. 62-842. GRENADA: St. Andrew Parish, Grenville Beach, no. 66-300.

A. spicifera (Vahl) Børg.:— GRAND CAYMAN: North Sound, Botabano, no. GRP-A.2495; North Shore, Grape Tree Point, no. GRP-A.2484; South Shore, Boddentown, no. 67-45. NEVIS: St. James Windward Parish, Mosquito Bay, no. 68-184. ANTIGUA: St. Philip Parish, Exchange Bay, no. 66-460. DOMINICA: St. Joseph Parish, south of the Macoucherie River, no. 67-412; St. John Parish, Douglas Bay, no. 67-491. ST. LUCIA: Castries Quarter, La Toc Bay, no. 68-409; Gros Islet Quarter, La Brellotte Bay, no. 68-282B; Laborie Quarter, Laborie, no. 68-339. BARBADOS: St. Michael Parish, Needham Point, no. 67-707; St. James Parish, Paynes Bay, no. 66-45; Christ Church Parish, Hastings, no. 66-201. BEQUIA: Adams Beach, no. 66-388. GRENADA: St. Andrew Parish, Grenville Beach, no. 66-283.

LAURENCIA Lamouroux, 1813

L. nana Howe (?):— ANTIGUA: St. Paul Parish, Crawle Bay, no. 67-220.

L. corallopsis (Mont.) Howe:— ST. KITTS: St. Peter Basseterre Parish, Conaree Beach, no. 68-50. DOMINICA: St. Andrew Parish, Calibishie Bay, nos. 67-547, 67-563. BARBADOS: Christ Church Parish, Oistins, no. 66-98.

L. papillosa (Forssk.) Grev.:— GRAND CAYMAN: South Shore, Boddentown, no. 67-49. ST. KITTS: St. Peter Basseterre Parish, Conaree Beach, no. 68-45, North Frigate Bay, no. 68-82. NEVIS: St. James Windward Parish, Sea Haven Estate, no. 68-206. ANTIGUA: St. John Parish, Hodge Point, no. 66-410. DOMINICA: St. Joseph

Parish, south of the Macoucherie River, no. 67-417; St. John Parish, Prince Rupert Bay, no. 67-478; St. Andrew Parish, Calibishie Bay, nos. 67-557, 67-563; Woodford Hill Bay, Pointe La Soie, no. R-207; St. Mark Parish, Soufrière Bay, no. 67-442. ST. LUCIA: Gros Islet Quarter, La Brellotte Bay, no. 68-322; Laborie Quarter, Laborie, no. 68-347. BARBADOS: St. Peter Parish, Six Mens Bay, no. 66-21A. BEQUIA: Adams Beach, no. 66-382. GRENADA: St. George Parish, Martins Bay, no. 66-294A.

L. gemmifera Harv.:– GRAND CAYMAN: West Shore, near the West Indian Club, no. 67-19. NEVIS: St. Thomas Lowland Parish, Pinneys Beach, no. 68-148; St. James Windward Parish, Sea Haven Estate, no. 68-202. DOMINICA: St. Andrew Parish, Calibishie Bay, no. 67-589(?).

L. poitei (Lamx.) Howe:– DOMINICA: Woodford Hill Bay, Pointe La Soie, no. R-234. BARBADOS: St. Lucy Parish, River Bay, no. 67-818 (?).

L. scoparia J. Agardh:– DOMINICA: St. Andrew Parish, Woodford Hill Bay, no. R-255.

L. obtusa (Huds.) Lamx.:– GRAND CAYMAN: West Shore, West Indian Club, no. 67-18; East End, Old Isaacs, no. GRP-A.2465; South Shore, east of Boddentown, no. 67-35. ANTIGUA: St. John Parish, Goat Hill Bay, no. 67-304, Wetherell Point, no. 66-476; St. George Parish, Judge Bay, no. 67-176; St. Philip Parish, Exchange Bay, no. 66-451. DOMINICA: St. Joseph Parish, south of the Macoucherie River, no. 67-413; St. Andrew Parish, Calibishie Bay, no. 67-588; St. Mark Parish, Soufrière Bay, no. 67-444. ST. LUCIA: Vieux Fort Quarter, no. 68-335. BARBADOS: St. James Parish, Coral Reef Club, no. 67-788.

L. intricata Lamx.:– GRAND CAYMAN: South Shore, Boddentown, no. 67-44. ST. KITTS: St. John Capisterre Parish, Black Rocks, no. 68-121A. DOMINICA: St. Andrew Parish, Calibishie Bay, nos. 67-546, 67-587. BEQUIA: Adams Beach, no. 66-381.

L. microcladia Kütz.:– GRAND CAYMAN: West Shore near Pageant Beach Hotel, no. 67-92. NEVIS: St. James Windward Parish, Sea Haven Estate, no. 68-201. ANTIGUA: St. John Parish, Hodge Point, nos. 66-411, 67-142. ST. LUCIA: Castries Quarter, La Toc Beach, no. 68-406.

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PLATES AND DESCRIPTIONS

PLATE 1.

Figure 1. Algal habitats on a highly dissected coast with exposed (far left) and sheltered rocky shores, as well as beaches (lower right) and beds of turtle-grass. Widely accessible for algae of shallow water. Antigua.

Figure 2 (lower). A rock-bordered deep bay, mostly sheltered from surf, readily accessible by boat for the intertidal rock vegetation. Antigua.

PLATE 2.

Figure 1. A long, sandy beach without significant rocky outcrops or an off-shore reef, and so no algae growing near shore or in the littoral belt, and few washed ashore. Nevis.

Figure 2 (lower). The vegetation of shelving beach-rock below a sandy beach. Darkening the rock a heavy growth of *Enteromorpha* with other algae indicating a substantial pollution. Barbados.

PLATE 3.

Figure 1. A sandy beach in front of a copse of the ill-famed manchineel trees, interrupted with frequent calcareous beach-rock outcrops, with neither pollution nor an off-shore reef. Barbados.

Figure 2 (lower). A characteristic association on such beach-rock, here consisting of tufts of individual clavate *Ectocarpus breviarticulatus* plants over a dark brown crust, probably of *Ralfsia*. Barbados.

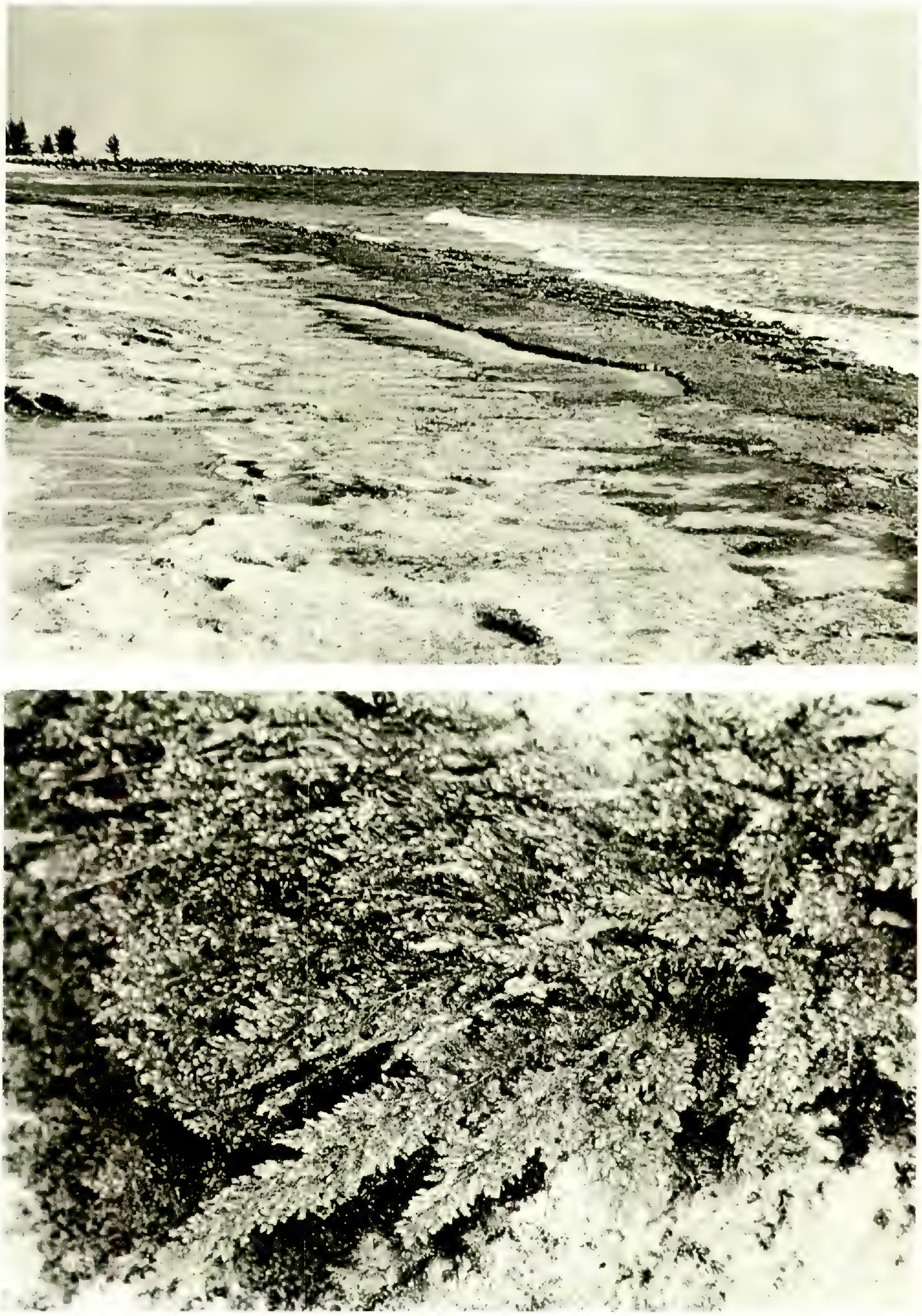

PLATE 4.

Figure 1. Extensive shelving calcareous beach-rock with tide-pools which, in right and left foregrounds, show dark colonies of *Cystoseira,* a very unusual occurrence in the West Indies. Grand Bahama.

Figure 2 (lower). Detail of a colony of *Cystoseira myrica.* Grand Bahama.

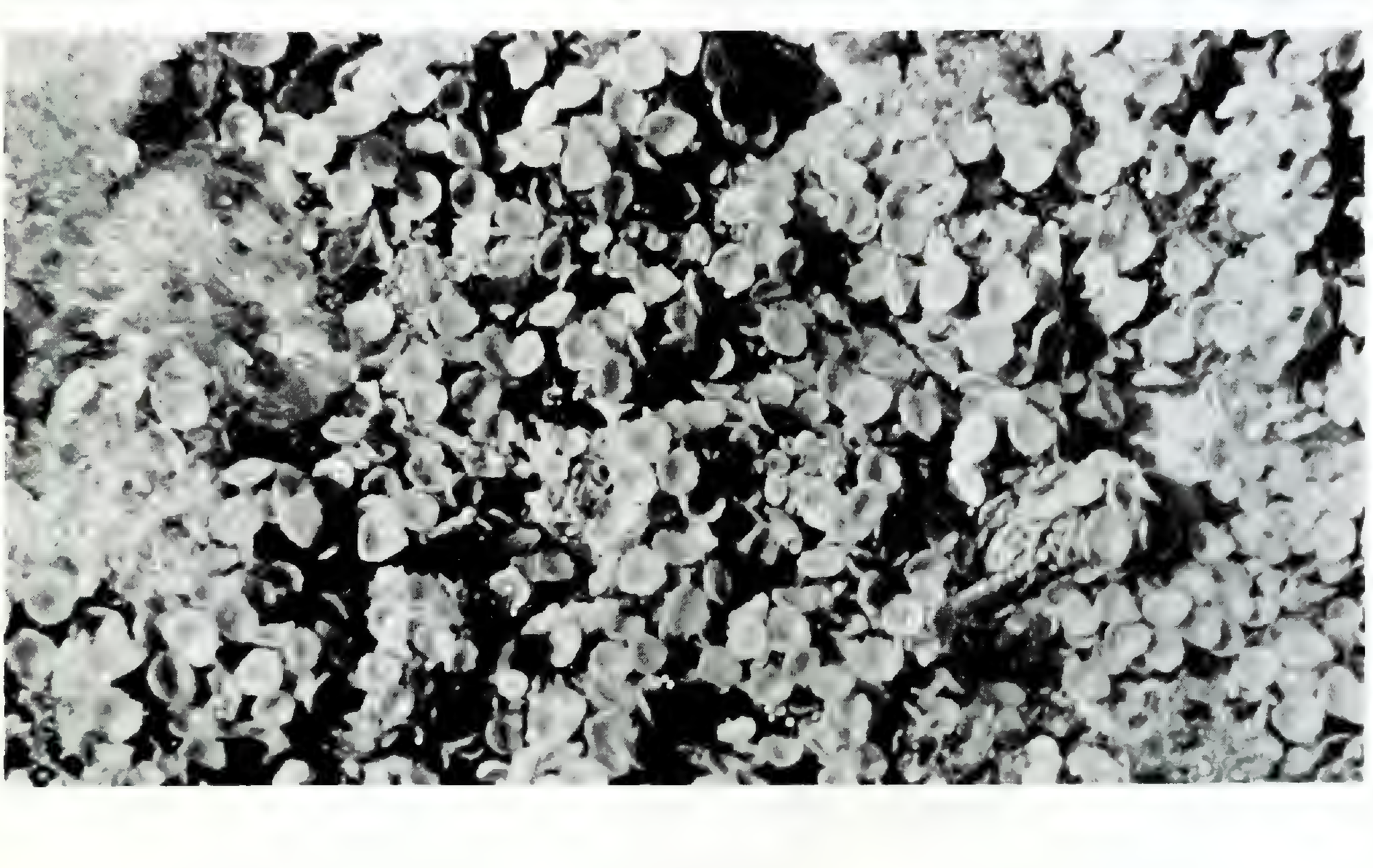

PLATE 5.

Figure 1. The margin of an inshore rock outcrop on a coast with moderate surf, showing the thick border of *Sargassum* as a mound on the edge. Barbados.

Figure 2 (lower). Detail of a similar border of the less common *Turbinaria* from a quieter shore. Antigua.

PLATE 6.

Figure 1. An abrupt shore-line difficult of access dropping to a border of non-calcareous rocks fully exposed to wave action, worn smooth and too unstable to support a good algal flora. Grenada.

Figure 2 (lower). A wide rocky shoal of partly cemented rock, calcareous or coated with lithothamnia, not exposed to severe wave action, and supporting a substantial intertidal and upper sublittoral flora. Bequia.

PLATE 7.

Figure 1. A moderately abrupt shore-line with large fixed non-calcareous boulders not exposed to particularly heavy surf, and not unstable. St. Kitts.

Figure 2 (lower). A characteristic vegetation on such rocks, usually consisting of small, wiry species 2–7 cm. tall, and here showing dentate branches of *Acanthophora* (chiefly at the left) and paler, more slender *Gelidiella* (toward the center). Barbados.

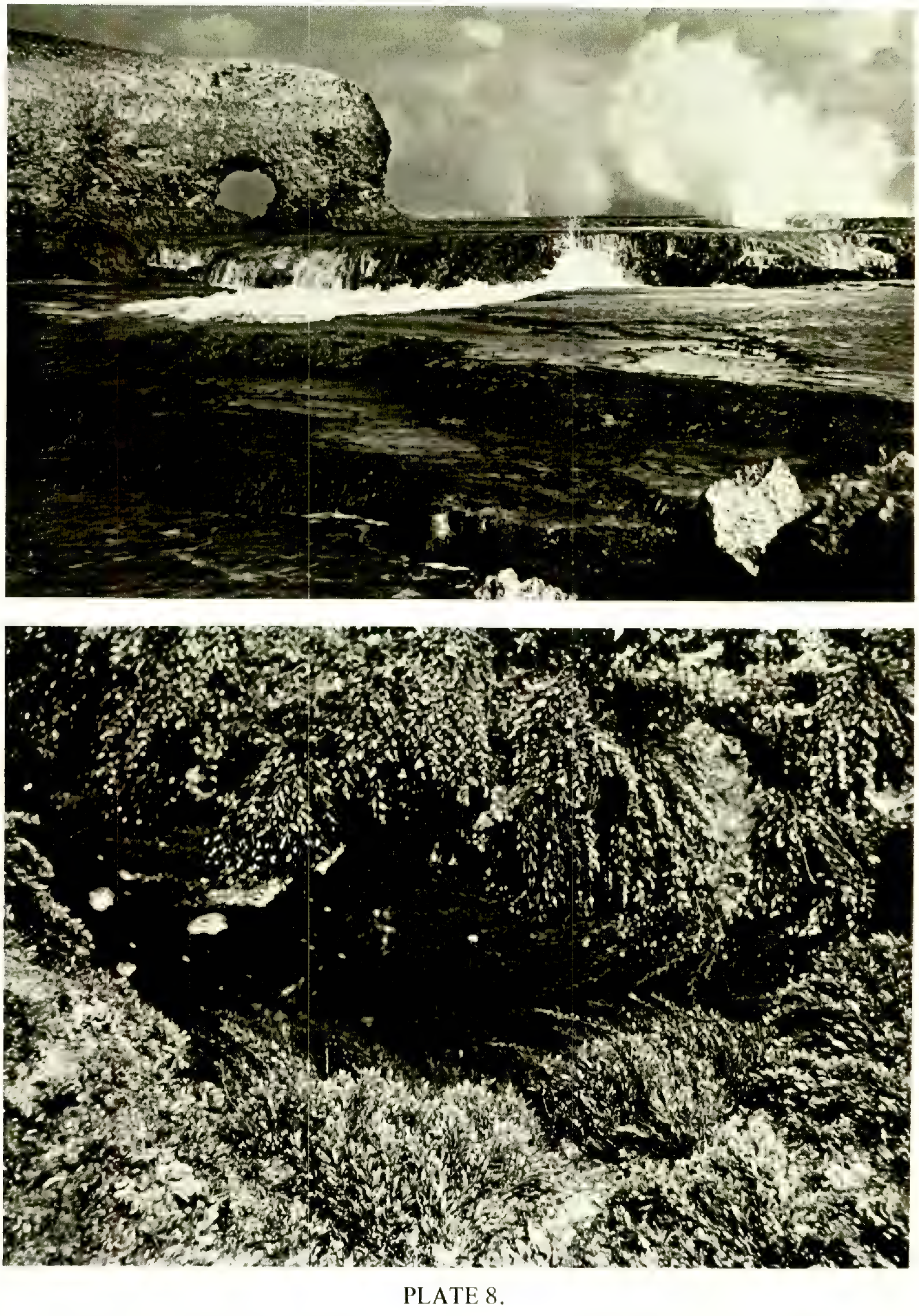

PLATE 8.

Figure 1. Extensive rocky shelves below cliffs exposed to very severe surf action. These are only accessible at low tide on relatively calm days. The flat surfaces bear a dense mixed vegetation of dwarfed wiry species hardly 1-3 cm. tall, often over crusts of lithothamnia. In crevices and surge channels these species can be found of normal stature, accompanying less resistant types absent from the exposed planes. Barbados.

Figure 2 (lower). On the outer sides of the ledges and in the channels *Sargassum platycarpum* (shown here) often dominates, replacing the Sargassa found on less exposed shores. Barbados.

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BOTANICAL EXPLORATION IN NUEVA GALICIA, MEXICO

from 1790 to the present time

by

ROGERS McVAUGH

University of Michigan

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Foreword

In 1949, after my first visit to Jalisco, I entertained the idea of compiling a flora of the State. The preliminary work of discovering what was already known about the plants of the State soon made it clear that a more natural floristic region would include not only Jalisco but also the States of Colima and Aguascalientes; it would take in southern Nayarit as far north as the end of the highlands that fall off from near Tepic to the broad coastal plain north of San Blas; northeastern Nayarit, southern Durango and southern Zacatecas as far west as the Río San Pedro and north to latitude 23°; portions of Guanajuato and Michoacán, eastward to an ill-defined boundary that is marked by the western and northern fronts of the mountains from Cerro del Toro (about 50 km east of Lagos de Moreno) southward to the Sierra de Pénjamo, Cerro Patambán, Cerro Tancítaro, and Sierra de Coalcomán. This region corresponds in a very general way to the old Spanish province or kingdom of Nueva Galicia, and for convenience' sake the title of *Flora Novo-Galiciana* is planned for the descriptive account of the plants. The boundaries of the area, and the principal vegetational features of Nueva Galicia in our sense, have been set forth in two publications.[1]

As in most preliminary floristic studies, botanical fieldwork in Nueva Galicia has stressed the collection of herbarium specimens. Summary publications resulting from the work were few indeed in 1949, including one long obsolete,[2] and two more local floras.[3] Except for what could be gleaned from such general works as P. C. Standley's monumental *Trees and Shrubs of Mexico,* it was necessary to search the taxonomic literature to find (mostly incidental) references to the work of collectors in the area. It transpired that approximately 5000 different collections of vascular plants had been cited in floras, monographs and revisions, but the information that could be obtained from such sources was incomplete from the standpoint of any floristic list, and unsatisfactory because of the high incidence of errors and inconsistencies of citation. A necessary preliminary to a revised floristic list therefore seemed to be an index to localities at which plants had been collected in Nueva Galicia, and an account of the work of the collectors to give body to the list of localities.

In the preparation of the following lists I have had the help of many friends and acquaintances, and it is a pleasure to extend thanks to all of these. Hardly any of the sketches of living collectors could have been completed satisfactorily without the cooperation of the persons directly concerned, and an equal measure of assistance has been received from the institutions who have been the recipients of letters and other documents, and plant-materials of all kinds. Needless to say I am wholly responsible for any errors that may have been introduced into the following pages.

Most of the initial work of compilation was done between 1954 and 1956, when I received favors on many separate occasions from botanical friends who happened to be strategically located. In this connection I want to mention the contributions made by

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[1]McVaugh, Rogers. Euphorbiaceae novae novo-galicianae. Brittonia 12: 145–205. 1961.
Rzedowski, Jerzy, and Rogers McVaugh. La vegetación de Nueva Galicia. Contr. Univ. Mich. Herb. 9: 1–123, 28 figs., map. 1966.

[2]Florula del departamento de Jalisco escrita en el año de 1859, por el Sr. Dr. Leonardo Oliva y communicada á esta sociedad, por el Sr. Dr. Alfredo Dugés. La Naturaleza 5: 88–99, 127–133. 1880.

[3]Castañeda, Alfonso Manuel. La flora del estado de Jalisco. Bol. Junta Aux. Jal. Soc. Mex. Geog. & Est. 3: 113–160. 1933. Gómez y Gutiérrez, Agustín. Flora silvestre del valle de Guadalajara. Bol. Junta Aux. Jal. Soc. Mex. Geog. & Est. 8: 185–260. 1945.

the late Maximino Martínez, then of the Instituto de Biología; of C. O. Erlanson, then of the U.S. Department of Agriculture; of Mrs. Roxana S. Ferris, then of Stanford University; and of C. V. Morton and A. C. Smith, then both of the U.S. National Museum. I am especially grateful to the authorities of the Muséum National d'Histoire Naturelle, Paris, who loaned for my study the entire collection made by Léon Diguet in Nueva Galicia.

More recently I was assisted greatly by Dr. Emilio Fernández Galiano, who made it possible for me to study the Sessé and Mociño manuscripts at Madrid in 1963, and by the late Faustino Miranda, who placed the archival materials of the Instituto de Biología at my disposal and aided me in other ways. A grant from the Field Museum supported my travel in Spain in 1963, and a grant from the National Science Foundation has supported the publication of this paper.

After 1950, and even earlier, as new roads began to stretch to every part of Mexico, and as automobile transportation became easier, the number of casual collectors rapidly increased. I have not been able to keep pace with them, and do not claim to have included the name of everyone who has collected a herbarium specimen in Nueva Galicia. I have included the names and collecting localities of recent collectors as these have come to my attention, but have not been able to work out sequences of localities, dates, and collection-numbers as completely as for the older collectors. I should be glad at any time to receive further information about recent collectors, or about any others who have worked and collected in Nueva Galicia.

Historical Summary of Fieldwork in Nueva Galicia

Spanish settlements were formed at Guadalajara, at Colima, at Tepic, and elsewhere in the western parts of Mexico, within a few years after the Conquest, so the native vegetation has been subject to modification by Europeans for more than four hundred years. Major changes have been brought about, especially in the vicinity of the larger cities, where heavy demand for fuel has caused the virtual extermination of the forests over large areas. Although the early chronicles included some mention of plants, no botanical work which is significant from our standpoint seems to have been done in this part of Mexico before the time of Charles III and the Royal Botanical Expedition to New Spain (1790–1792). Brand (1960[1]) remarks that Francisco Hernández (in Mexico 1570–1577) seems to have passed through the southern part of our area, via Uruapan, Apatzingán, Coalcomán, Colima, Jilotlán, Sayula, Jiquilpan, Pénjamo, Guanajuato, etc.; Brand also thinks it likely that the expedition led by Sessé in 1790–1791 made an attempt to follow Hernández' route in order to obtain illustrations of his plants, and to collect where he had collected.

Whether or not Brand is correct in this assumption, the party that included three botanists (Sessé, Mociño, and Castillo) and two competent artists (Echeverría and Cerda), left Mexico City in May, 1790. Passing through Guanajuato and central Michoacán, they spent some weeks in Apatzingán. Here and in other localities a little farther west, they studied and collected specimens of more than 140 species. Finally they passed on to the coast at Coahuayana, then circled around the Nevado de Colima on the eastern side and went on through Zapotlán and Sayula to Guadalajara, where they stayed for about four months before moving down to Tepic and northward along the coast into Sinaloa, probably in late August or September, 1791. Sessé and Castillo returned to Mexico, while Mociño was taking part in an expedition to the Pacific Northwest.

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[1]References cited by author and date only may be found in the bibliography at the end of this paper.

After the work of the Botanical Expedition to New Spain, there seems to have been no botanical exploration in Nueva Galicia until 1825–1827, when Thomas Coulter collected a few specimens in the course of rather hurried trips across country. Botanists of two British naval expeditions collected along the coast at Manzanillo and San Blas, and inland to the mountains around Tepic (see Barclay, Beechey, Collie, Lay, Hinds, Sinclair, 1827–1839), and Seemann, also a member of a British naval expedition, explored along a transect from Mazatlán to Durango and from Durango nearly to Tepic (1849–1850).

Some collections were made in the interior about the same period. Méndez, who was apparently a native of Guanajuato, collected extensively near León and Villalpando, probably about 1830. Leonardo Oliva lived in Guadalajara and collected near there soon after 1850. Several travelers passed through Nueva Galicia and made collections on the way, including the Belgian Galeotti (1836–1837), the collector for the Horticultural Society of London, Hartweg (1837–1839), and the North American amateur of botany, Josiah Gregg (1849).

Two whose collections were disappointing from the botanical standpoint were the Hungarian Xántus, who lived at Manzanillo from 1862 to 1864, and the incredibly industrious horticultural collector, Benedict Roezl, who visited Manzanillo and other localities on the Pacific Coast at various times from 1868 to 1875. Almost equally unrewarded was the work of Kerber, who spent at least two years in Colima (1878–1881) and made many collections there; unfortunately most of the collections were destroyed in Berlin in 1943.

The Modern Period, 1886–1950

Edward Palmer, a professional collector, visited Guadalajara, Tequila, and Chapala in 1886, and as his specimens were widely distributed, and were studied and reported upon immediately by Sereno Watson and Asa Gray, word of the richness and diversity of the flora of western Mexico began to reach other collectors. Cyrus Guernsey Pringle, even more active than Palmer as a professional botanical collector, visited Jalisco more than 20 times from 1888 to 1908, making the flora of the vicinity of Guadalajara as well known as that of any other part of Mexico. Palmer returned to Nueva Galicia, to Tepic in 1892, to Colima and Manzanillo in 1890–1891, and to the city of Colima again in 1897. Mexican botanists were active during the heyday of Palmer and Pringle; Bárcena and Juan Oliva, both natives of Jalisco, did some collecting in that state.

About 1890 also began the influx into Mexico that has continued to the present day, of travelers who have collected a few (or sometimes many) plants in connection with their principal work, or merely as a hobby. W. G. Wright, primarily an entomologist, collected plants near San Blas in 1889. Marcus E. Jones, traveling in Jalisco and Colima as a consulting geologist, made important collections of plants in 1892 (Jones returned to Jalisco and Nayarit, this time solely for the purpose of collecting plants, in 1927 and 1930). Frank Lamb, when a university student, made a collection in several sets, in Sinaloa and Nayarit (1895), planning to sell the duplicates to make expenses of his trip. The German archeologists Eduard and Caecilie Seler visited Nueva Galicia in 1887 and again in 1897, and collected a few vascular plants, as did the mycologist Holway (1898–1903), the zoologist Hans Gadow (1904), and Hermann Ross (1906), who was a specialist on plant-galls.

Two important botanical collectors at the turn of the century were León Diguet and J. N. Rose. Diguet, a Frenchman perhaps best described as an ethnobotanist, made seven expeditions to Mexico (1889–1913), and collected extensively, if haphazardly, in Nueva Galicia. His principal interest in this region was in the life of the Cora and Huichol Indians, and he made at least three long trips into northern Jalisco and

Nayarit to visit these Indian communities. His collections from these remote areas are still the largest ever made there, although those of Rose have become more important because they were studied by specialists within a short time after their collection.

Rose, a botanist of the United States National Herbarium, travelled with the zoologists Nelson and Goldman from early August to late September, 1897, during which time the party crossed the Sierra Madre Occidental from Acaponeta, Nayarit, to Guadalajara. Rose made a collection of more than 1500 gatherings, many of them from localities never visited by botanists before or since. Rose returned to Mexico on several trips after this one, and visited Nueva Galica in 1899, 1901 and 1903.

Nelson and Goldman usually collected plants in the course of their extensive wanderings throughout Mexico for other purposes. In Nueva Galicia the most interesting collections were those made by Nelson, early in 1897, on a trip from Ameca, via Mascota and San Sebastián, to the coast of Jalisco and on to Tepic. Nelson also collected around the (then relatively undisturbed) east end of Lake Chapala in 1902–1903, and in the high mountains of western Michoacán a few weeks thereafter.

During the first decade of the 20th Century several North American visitors collected in different parts of Nueva Galicia. Goldsmith came to Mexico for the Peabody Museum in Salem, Massachusetts; his collections, made in 1905, included a series from the Nevado de Colima and another from the country of the Cora and Huichol Indians above Jesús María. Emrick collected plants, apparently as a hobby, in the lowlands of Colima and Michoacán. Two scientists from the University of Chicago, Barnes and Land, accompanied Pringle in Jalisco for a time in 1908. Orcutt, naturalist and collector, travelled in Jalisco and Colima in 1910, and in the same year A. S. Hitchcock, the well known agrostologist, pursued his specialty by collecting at selected localities in Colima, Jalisco, and Aguascalientes.

After 1920, when political conditions in Mexico became somewhat more settled, opportunities for general botanical collecting became more frequent. Mrs. Ferris made a large collection in southern Nayarit in 1925, and Mrs. Mexia an even larger collection in Nayarit and western Jalisco in 1926–1927. Her collection from around San Sebastián is still the only large one ever taken from that part of Jalisco. I have already remarked on Marcus Jones' visits of 1927 and 1930. Howell collected briefly along the Pacific Coast in 1932 (as did Elmore in 1939), and Pennell worked in Nayarit and adjacent Jalisco in 1935. In 1940–1941 several botanists, including Mrs. Langman, Cutler, Moore, and Leavenworth and Hoogstraal, were active in Jalisco and Michoacán, after which there were no very sizeable collections in Nueva Galicia for almost a decade.

Botanists resident in Mexico have with few exceptions been based in Mexico City, and with the exception of Bárcena and Oliva none until recent years has collected actively in Nueva Galicia. Altamirano, Reiche, and Martínez visited Jalisco, as did Miranda in 1959. Hernández, in connection with his work on cultivated plants, has taken many specimens in Colima, Nayarit and Jalisco (1943–1944, 1946–1949, and thereafter). Rzedowski, who has participated in the planning for a *Flora Novo-Galiciana* for more than a decade, has travelled many times in Nueva Galicia, and has made collections in a number of interesting and seldom-visited localities. Sra. de Puga has also been able to reach several localities that have produced interesting finds, notably the mountains above San Juan Cozalá, and her colleague Díaz Luna has been active especially near Guadalajara. In 1958 Ladislao Paray made a 5-day trip for collecting, to Tepic and the nearby mountains.

Collections Since 1950

The first University of Michigan expeditions to Jalisco were in fact in 1949 (see Crum and Wilbur, or McVaugh). These and the later ones are described under the

names of W. R. Anderson, Denton, Dieterle, Feddema, Graham, King, and McVaugh. Collectors from Michigan have made an effort to reach as many parts of Nueva Galicia as possible, and the total number of new collections (gatherings) accumulated has been about 20,000. During the same period notable collections, either large in size or from especially interesting localities, have been made by Clarke (1967–1969), Cronquist (1962, 1965, 1970), Detling (1961–1962), Gentry (1951 and subsequently), Gregory and Eiten (1956), Iltis *et al.* (1960), Muller (1951), Norris (1970), Puga (from about 1960 to the present), Reeder (1950, 1953), Rowell (1947), Rzedowski (1960 to the present), Turner (1950), Weintraub and Roller (1955), and others whose names are listed below.

Index to Names of Collectors

The names of collectors are arranged alphabetically, except for some of those who collected with others whose names are ordinarily cited first; e.g. in the case of Sessé and Mociño, the principal entry is under Sessé, with a cross-reference under Mociño. The alphabetical list also includes the names of persons erroneously reported to have worked in Nueva Galicia. Notes on itineraries and cŏllections, and notes on the ultimate disposal of the collections, have been included in as much detail as seemed possible and useful. No attempt has been made to give the dates of birth of collectors that are thought to be still living.

Aguirre, S. E. A specimen of *Neomammillaria occidentalis,* according to Britton and Rose,[1] was obtained by this collector at Manzanillo in October, 1922.

Alamán, Lucas (1792–1853). A native of Guanajuato, Alamán as a youth lived through the moving and tragic events of the Mexican Revolution. After completing his education in Europe, he returned to Mexico in 1819 to take a prominent part in the affairs of the new nation, and to become well known as statesman and historian.[2] In spite of his preoccupation with political affairs, he maintained strong interests in mineralogy and botany. When after the death of his father he moved with his mother to live in Mexico City, he studied under Vicente Cervantes, probably in 1812. He travelled widely in Europe from 1814 until 1819. In Madrid his interest in natural science was stimulated through early acquaintance with such men as Pablo la Llave, Casimiro Gómez de Ortega and Mariano de la Gasca, botanists all. In August, 1817, on a brief visit to Geneva, he met the elder DeCandolle, who extracted from him a promise that upon his return to Mexico he would send to Geneva a collection of the plants of Guanajuato. How well this promise was kept may be inferred from the discussion below. Alamán carried on a long correspondence with DeCandolle, and considered him a good friend.

The pages of DeCandolle's treatments of the Compositae, in the fifth, sixth, and seventh volumes of the *Prodromus,* abound with references to plants from the State of Guanajuato, collected and communicated by the author's friend Lucas Alamán, or by one Méndez, or apparently in some cases by the two men jointly. Specimens attributed to Alamán usually have the general locality "Guanajuato," or merely "Mexico," although some few are stated to have come from Oaxaca or from the vicinity of the city of Mexico. About half of Méndez' collections, on the other hand, are said to have come from the "province of Leon," "west of the city of Guanajuato"; many of the others are from Villalpando, a mining center just east of Guanajuato.

According to a list kindly sent me by the late Dr. L. H. Shinners, there are in the fifth volume of the *Prodromus* 43 references to plants collected by Alamán. This would suggest that if the number of references in volumes 6 and 7 is correspondingly large, Alamán sent at least 100 species of Compositae to DeCandolle, and presumably specimens of other things as well.

References to Méndez, in the pages of the *Prodromus,* are approximately as numerous as those to Alamán. For this information I am likewise indebted to Dr. Shinners. Neither from the *Prodromus,* however, nor from any other source, have I

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[1]Cactaceae 4: 161. 1923.

[2]See Valadés, José C. Alamán [:] Estadista e Historiador. XII, 576 pp., frontisp., 15 plates. Mexico, J. Porrua e Hijos, 1938.

been able to learn anything else definite about Méndez. The only suggestion I can make is the following: In the Valadés biography of Alamán are two references (pp. 24, 29) to Juan Méndez, who was the school-companion of Don Lucas during his early days in Guanajuato. It may be that this is the same Méndez who in later years collected plants in the Province of León for DeCandolle.

It does seem clear from statements in the *Prodromus* that there was some association between Alamán and Méndez, and apparently at least a part of the specimens collected by Méndez were sent to DeCandolle by Alamán. Under *Baccharis sulcata,* for example (Prodr. 5: 419), is the following: "circa Villalpando legit cl. Mendéz . . . (v. s. ♂ comm. à cl. Alaman)."

In another place it may be inferred that the two men had worked or collected together (Prodr. 5: 603, under *Bidens foeniculifolia*): "ad occid. urbis Guanaxuato in prov. Leoninâ leger. et mecum comm. cl. Mendez et Alaman."

As noted above, I have not been able to find any biographical notes on Méndez, and on Alamán little has been published in botanical works except brief notes by León (Bibl. Bot.-Mex. 8. 1895), Rose (Contr. U.S. Nat. Herb. 5: 187. 1899), and Standley (Contr. U.S. Nat. Herb. 23: 639. 1923). Neither man is noticed in the *Phytographie* of Alphonse DeCandolle, and in the first published part of the proposed index to collectors (Regnum Veg. 2, pt. 2, 1954), Alamán's name does not appear. Fortunately for the historian, he was eminent in fields other than botany; he was, in fact, an outstanding public figure in the early history of the Mexican Republic. The wonder is that he had any time left for his avocations in the midst of his many responsibilities.

It may be inferred from the pages of the *Prodromus* that Alamán was more than a mere collector, for in several cases reference is made to new species and even new genera proposed by him, in a letter written in 1831 (e.g. DC. Prodr. 5: 169; 5: 172; 5: 565; 6: 428; 6: 431). On at least one occasion DeCandolle specifically acknowledges his indebtedness to Alamán; in writing of *Eupatorium triangulatum* (Prodr. 5: 172) he says: "à Mexico misit cl. Luc. Alaman cum plur. aliis rarissimis."

Alava, Reino. In December, 1957, Alava passed through Colima, Jalisco, and Nayarit, making (with Stanton A. Cook) a collection of about 300 numbers under the auspices of the Associates in Tropical Biogeography, University of California (UC). A duplicate set of the collections is at the University of Michigan (MICH).

Altamirano, Fernando (?1850–1908). Altamirano was director of the Instituto Médico Nacional, of Mexico, and collected botanical material, especially of medicinal plants, in southern Mexico. His no. 20, collected at Guadalajara in October, 1891, was made the type of *Eryngium altamiranoi* Hemsl. & Rose.

Anderson, Christiane Eva (Seidenschnur). See William Russell Anderson.

Anderson, Edgar (1897–1969). Anderson, then Geneticist at the Missouri Botanical Garden, worked in Jalisco for several months in 1943–1944 and collected some herbarium specimens which are now in the permanent collection at the Garden (MO). He supplied the following statement in regard to his botanical activities in Jalisco:

> I lived in Guadalajara, or to be more precise, its suburb San Pedro Tlacquepaque, from the 8th of October, 1943 until the last week in March, 1944. I was mainly concerned with studying plant to plant and variety to variety differences in maize and making a record of them including herbarium specimens. The methods worked out at that time form the basis of my method "Pictorialized scatter diagrams" which I have since adapted to herbarium use.
>
> I traveled mostly on foot but also used the train and the autobuses. I went in the fall to Tuxcacuesco on the headwaters of the Rio Armeria. In the spring I went up to Tapalpa and to Ameca. I have no idea how many herbarium specimens of the conventional sort I brought back with me. The only time I made a real effort to get any was when I went to Tuxcacuesco, since I knew that area had not been collected yet.

Anderson, William Russell. See also McVaugh (1965). While a graduate student at the University of Michigan, Anderson made three extended collecting trips that included Nueva Galicia. In 1966, working with Chester W. Laskowski, he made an effort to get material for a revision of *Gaudichaudia* and related Malpighiaceous genera, while Laskowski concentrated on the genus *Montanoa* (Compositae). They came into Jalisco from the north, via Valparaíso, Huejuquilla, and Mezquitic, crossed to Aguascalientes via Huejúcar, returned to Jalpa and continued to Guadalajara.

Collections were nos. 3586–3651 (Aguascalientes, northern Jalisco, Zacatecas, September 11–16); 3652–3702 (near Guadalajara and Etzatlán, and on a trip to Tepic, September 18–21); 3703–3777 (Guadalajara to Autlán and Barra de Navidad, September 24–26); 3778-3780 (La Huerta to Cuautitlán, September 27); 3781–3847 (trip from Autlán to Sierra de Manantlán ["Cerro de Muñeco"] via El Chante, September 28–30); 3848–3874 (Cocula, Guadalajara, and vicinity of Lake Chapala, October 1–3); 3875–3885 (Guadalajara to Zapotlanejo and La Piedad, October 5–6). After a sojourn in eastern Mexico, Anderson and Laskowski returned via Jiquilpan, Mazamitla, Barra de Navidad, Juchitlán, Guadalajara, and Tepic (nos. 4534–4552, December 15–18).

In August 1968, with his wife Christiane Anderson and Melinda Denton, on an excursion primarily devoted to a search for material of the genus *Oxalis*, Anderson collected nos. 5071–5112 (August 9, slopes of the *barranca* north of Guadalajara), 5113–5155 (August 11, Volcán de Tequila), 5156–5179 (August 13, hills near Lake Chapala, and between Chapala and Guadalajara).

In December, 1969, primarily to collect material for a revision of the genus *Trixis* (Compositae), William and Christiane Anderson returned to Nueva Galicia, coming in via Villanueva, Jalpa, Calvillo, Encarnación de Díaz, and Lagos. They collected nos. 5239–5281 (December 30–31, in Zacatecas), 5282–5284 (December 31, east of Calvillo), 5285–5291 (January 1, 1970, in Jalisco). After collecting in southeastern Mexico for about 7 weeks, they returned to western Michoacán late in February and collected nos. 5873–5898 (February 25–26, mostly on the slopes below Dos Aguas, west of Aguililla), 5899–5900 (February 27, on the road to Los Reyes and Cotija), 5901–5986 (March 1–3, near Mascota and along the road to San Sebastián), 5987–6001 (March 3, vicinity of San Sebastián and road to Puerto Vallarta), 6003–6005 (March 5, 5 km E of Las Palmas), 6006–6056 (March 7, near the ocean S of Puerto Vallarta), 6057–6137 (March 7, hills E and SE of Cabo Corrientes, [vicinity of El Tuito]), 6138–6154 (March 8, northwest of Chamela to Cihuatlán); 6155–6163 (March 9, 10 km N of Juchitlán), 6164–6165 (March 10, west of Amatitán, road to Tepic).

The numbers used by Anderson are those of his own series, but the specimens collected in 1966 were distributed under the names of Anderson and Laskowski, and those taken in 1968 and 1969–70 under the names of Anderson and Anderson. The principal set of the collections is at the University of Michigan (MICH).

Arroyo F., ————————. See Muller.

Avalos, Wenceslao. See McVaugh (1960).

Azcón, Ernesto. Collected pines, as cited variously in Martínez' *Los Pinos Mexicanos*, edition 2, 1948. In Jalisco Azcón collected chiefly between Talpa and Bahía de Bandera, near Cuale and Mesa de Corazón.

Baad, Michael Francis. See McVaugh (1965).

Bárcena, Mariano (1842–1899). A native of Ameca, Jalisco, Bárcena was widely known in his time as a student of the natural sciences. He is probably best known to botanists as the author of the "Ensayo Estadístico del Estado de Jalisco" (Mexico, 1888; also in An. Min. Fom. Rep. Mex. 9: 1–729. 1891). This work includes chapters on the flora, on agriculture, horticulture, naturalized plants, and lists of characteristic

and well known species of various climates and soils. Bárcena also contributed to *La Naturaleza* and to other publications a number of notes on botany, geology, mineralogy and anthropology. He was especially interested in the relations between plants and environment, and the adaptation of new plants to Jalisco.

Bárcena formed a private herbarium, which passed into the hands of Dr. Manuel Urbina and ultimately became a part of the National Herbarium of Mexico (MEXU), now in the custody of the Instituto de Biología, of the National University. In Urbina's *Catálogo de Plantas Mexicanas (Fanerógamas)* (Mexico, 1897) were cited approximately 400 collections made by Bárcena, mostly in Jalisco in 1886 and 1887. The Jalisco collections include about 70 which are un-numbered, and more than 300 which are serially and more or less chronologically numbered (nos. 3–767). The localities at which Bárcena collected in Jalisco, as cited by Urbina, are nearly all in the vicinity of Guadalajara except for a series from Ahualulco and Santa Cruz de Ahualulco, and additional series from localities along the way between Guadalajara and the Nevado de Colima. When Bárcena was compiling geological and meteorological information for his *Ensayo Estadístico,* he made at least one long visit to the volcano, by way of the road to Zapotlán, the valley of Tuxpan and the Hacienda San Marcos. He seems to have made the ascent of the Nevado on at least two occasions, and to have explored the upper slopes with interest; Urbina cited about 50 collections made on the mountain by Bárcena, and Bárcena himself published a sketch of the vegetation and a list of species characteristic of different habitats and elevations, between the summit and the lower slopes of the Barranca de Beltrán (Ensayo Estadístico, pp. 366–368).

The precise dates of Bárcena's collections may differ in some instances from the dates published by Urbina. Sometimes the published dates seem to represent dates of flowering, rather than the actual days on which the collections were made; in other instances the published dates seem to be erroneous. Nos. 51–57, for example, are all reported as from Belén near Guadalajara, all dated September 24, but the year given as 1885 (once), 1887 (twice), and 1886 (4 times). Plants from the Nevado de Colima are assigned flowering dates which include 16 of the 24 months of 1886 and 1887, but it is not to be inferred from Bárcena's published writings that he visited the mountain on very many occasions.

From meteorological data published by Bárcena (An. Min. Fom. Rep. Mex. 9: 329–349. 1891), and for which the actual observations are stated to have been made by him, the following itinerary may be established for him in October, 1886: Santa Ana Acatlán (October 13); Sayula (October 14); Zapotlán (October 14–15); Santa Cruz de Duque (October 16); [San Marcos, about October 18]; summit of the Nevado de Colima (October 20); Tonila (October 22–23); summit of the Nevado de Colima (October 28); Hacienda de la Concepción del Volcán (October 28); Atenquique (October 30); Zapotlán (October 31). At the time of Bárcena's visit the Volcán de Fuego was in active eruption, and one of the purposes of his ascents of the Nevado was to observe the activity from a superior vantage point (Mem. Soc. Cient. Alzate 32: 476–480. 1915).

A biographical sketch of Bárcena, with a portrait, appeared at the time of his death (La Naturaleza II. 3: 1–V, [563]. 1903).

Barclay, George. Barclay was selected "from among the young men employed in the Royal Botanic Gardens at Kew" to act as Botanical Collector attached to H. M. S. Sulphur, which left Portsmouth on December 19, 1835, on a "surveying expedition destined for the Pacific &c &c." The Sulphur reached Rio de Janeiro on February 19, 1836, passed on to the south and rounded Cape Horn, anchoring in Valparaiso Bay on June 9 after a passage of 61 days from Montevideo. She worked on slowly up the west coast of South America. The expedition reached Gorgona Island, site of numerous collections, on January 10, 1837, and remained in the region of Panama until mid-March. They continued northwestward along the coast of Central America for the

next six weeks. Barclay kept a journal, whose day-by-day records provide much information about the botanical activities of the botanists of the Sulphur. The diary includes full accounts of Barclay's own botanical excursions, and it is apparent from his statements that he must have been responsible for a large part of all the plant-materials secured by the expedition, for he made plant-collecting a full-time job whenever he was allowed to land. Sometimes he notes that he was accompanied by Dr. Sinclair (q. v.). The original set of Barclay's plants, largely unstudied until recent years, is in the British Museum (BM; cf. Regnum Veg. 2, pt. 2: 55. 1954). A second set, that studied by Bentham in the preparation of the "Botany of the Voyage of the Sulphur," is in Sir William Hooker's herbarium, now at Kew (Bot. Sulph. 182).

The following excerpts from Barclay's journal[1] pertain to the periods when the expedition was on the Pacific Coast between San Blas and Manzanillo, beginning with the month of May, 1837 (Volume 1, p. 132):

> The month of May brought us moderate weather and light variable winds which was rather tantalizing as our water was getting short. Many boobies flocked about the Ship, and at times almost took possession of the rigging, and at length the Captain turned the hands up to kill boobies, when in less than a quarter of an hour 2 Doz of them lay dead on deck. In consequence of the light and variable winds retarding our progress so much, our allowance of water was reduced to 4 Pints a day on the 17th.
>
> This reduction although necessary was not very welcome, as the weather was very hot and our water was of all things what we wanted most. On the 18th we had a splendid view of the Volcano of Colima—one of the most active of its kind in South America. – Towards evening we opened the large bay of Manzanilla and a boat was manned under the command of an officer who was sent to search for water meanwhile the Ship was anchored outside in 20 fms. The boat soon returned and the /p. 133/ officer in charge reported that fresh water could be obtained and that a Mexican Barque lay at anchor inside the bay. We got under way on the 20th and run into the proper anchorage where we came to, in 12 fms. about ¾ of a mile off shore. I was allowed to land with the watering party opposite to the Ship where they commenced filling the Casks from a dirty hole mis named "a well."
>
> The bay of Manzanilla is situate in latitude 18°59′ north, and longitude 104° west; it is about 5 miles in depth, and sheltered by a high range of reddish coloured hills covered with cactii and brush wood. The landing is good and the anchorage considered safe; but the fresh water is all but unfit for use. This however might be improved by either digging a proper well, or bringing the water from the interior by an aqueduct such as are met with in the highlands of Peru: the present well or rather "hole" is a mere reservoir for filth, and moreover is below the level of the stagnant Lake of Cuyutlan, which swarms with alligators &c and being only about 200 yards from the well in question, the water must filter through the sandy beach from the Lake in to it.
>
> From Manzanilla to the City of Colima is a distance of 33 leagues along a very rugged road. /p. 134/ The city and its Suburbs are said to contain a population of 30,000 souls. Two men are stationed in Manzanilla to look out for the arrival of vessels, and to carry such intelligence to the Captain of the Port who resides in the City as may be necessary. The Captain then starts post haste for the Port in order to afford such assistance in forwarding goods to the City and in procuring supplies of fresh provision which are only to be obtained by a days notice previous to their being wanted. The people appear to be industrious, for they think nothing of coming from the City to the Port when vessels are lying there, to sell a few Poultry, fruits, Eggs or some similar triffle, and as there are no houses in the Port each person erects a temporary bower made of branches to protect them from the dew at night.
>
> The people wear the Mexican Costume—The men wear velvet breeches open at the knees & worn over white linnen drawers which reach down to the ancle which is protected by a pair of leather gaiters and Mexican boots. A large felt hat, embroidered with a roll of gold or silver lace, is worn by all classes and when travelling the Body is covered by a Serape which is a blanket like Covering some what resembling a Poncho but longer /p. 135/
>
> The Country is hilly and rugged—the Soil ferugineous and rocky, and in many places little of any kind exists. The botany is poor excepting the Cactii family which are numerous. Cactus hexagonus attains the height of 40 ft. The Melo [?] cactus and C. prolifer are abundant and

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[1]Barclay, George (mss.) Journal / of / a voyage round the world / including / excursions to the north west coast of America / and among the / islands in the Pacific and Eastern Seas / &c &c &c / in the years / 1836, 1837, 1838, 1839, 1840 and 1841.

Original in the British Museum (Natural History). Photostatic copy loaned by F. G. Meyer, Missouri Botanical Garden, 1954. Volume 1, 268 pp.; volume 2, 256 pp.; volume 3, 102 pp.

handsome. – Acacia vera yields a gum which the people use for healing recent wounds which it is said to accomplish most effectually.

We sailed from Manzanilla Bay on the 21st at 4 a.m. and on the 26th we doubled Cape Corrientes in latitude 21° north. – Mount Juan which according to Captain Beechy is 6000 feet above the level of the sea appeared in the distance on the 27th and on the 28th the Sulphur was anchored off the Port of San Blas, which we entered during the day.

San Blas is an island situate in latitude 21°32′ and longitude 105°13′33″ west; surrounded by a salt marsh–a powerful agent for fever and a complete hotbed for the most annoying insects. – The Port or Playa is a straggling group of low houses built of mud and whitewashed. There are a few small "European stores" for the sale of dry goods particularly French. – /p. 136/.

The Port of San Blas like most Spanish towns has an immence proportion of [Pulquerías] or grog ships, which might at first lead strangers to believe that the people lived upon "Suction."

The upper town of San Blas is built upon a rock which is inaccessible upon all its sides, but one, and is about a mile distant from the Port. Never did I see such a dilapidated place inhabited–the Arsenal a building of stone, and once the pride of the Spaniards, is now disused and fast crumbling into decay. – The church unroofed and but for the temporary remains of an altar yet standing within its ruins we would be at a loss to know to what purpose the building had been originaly destined.

The population of the upper and lower towns is estimated at 1100, but in the rainy season when fever prevails, the people remove to Tepic, leaving only servants & the very poorest class of people behind perhaps about 250 altogether. –

I employed myself botanizing in the vicinity of the Port during the 29th and 30th with very bad success. On the evening of the 30th Captain Belcher intimated his intention of going to the City of Tepic and said I might take /p. 137/ an excursion with him if I chose, which of course I was very happy to accept. I had only to pack up some paper and my mill boards before I was ready to join him in the Port where we remained all night.

Wednesday May 31st the horses were ready at 3 a.m. according to order, we were all ready to start a few minutes after. The party consisted of the Captain and 3 of the officers, myself and a guide. Our road led us over a [word illegible] marshy country for the first five hours, but passing the village of Guadestemba [Huaristemba], we ascended rapidly and the track became at once mountainous and picturesque.

We breakfasted at the Rancho of a well known dame, Doña Manuela, where travellers to and from San Blas and Tepic always put up at; and then continued our journey to the city.

The road continued our ascent upon the rugged hills partially covered with vegetation chiefly Palms Astrocaryum aculeatum and Chamaerops gracileps. – Opuntia cochinilifera and O. nonacantha formed fences in many parts along the line of road, which now led us over a precipice of considerable height whose base was washed by a small, but rapid mountain stream. I gathered specimens /p. 138/ of a very handsome Zinnia, several kinds of Tagetes and a scarlet flowered Euphorbia. Since leaving the Rancho de Doña Manuela we passed the villages of Navarette and Rancho Guarra, and at 4 PM opened to view the City of Tepic pleasantly situate in a valley surrounded by a chain of volcanic mountains terminating with San Juan. We entered the City in the evening and took up our residence at the house of Alexander Forbes Esqr a countryman of my own, where we were received in the most kindly manner possible. –

Thursday June 1st [1837] I set out from the City early upon a Botanizing excursion to mount San Juan. The road led me through the village of Santa Cruz, whence I crossed the sierro [?] of Halisco near which our Consul has a Country seat. The low land is so dry at this season of the year that scarce a blade of grass is to be seen. The surrounding country is quite free from the imcumbrance of wood excepting San Juan which is covered on the high ridges with a forrest of Pine. The ground between the City & this mountain is much broken up by the periodical rains and in many /p. 139/ places exhibits fearful chasms. In these openenings [sic] I found many interesting and beautiful Plants particularly Salvias, Syngenesious plants, Euphorbias &c. I reached the top of San Juan about mid-day and gathered specimens of the Pinus. The trees are not large but handsome, from 18 to 40 feet high: leaves in fives and the cones from 8 to 12 inches in length. I was fortunate enough to procure cones, full of fine seeds which I forwarded to Kew. Two very handsome species of Lupinus grew under the shade of the Pine trees, one of which with straw coloured flowers, the other with Blue and Purple, but I was unable to procure good specimens of either. The Soil on San Juan is a brownish coloured loam upon a bed of Marle. – I returned to the City in the evening and laid out my specimens into dry papers, and arranged my few seeds.

Friday June 2d I renewed my botanizing duties again this morning by commencing upon the banks of the river Tapic, and continuing near the course for several miles but was much less fortunate than yesterday. A few water plants collected near the 'Salto de agua' or water fall, was nearly all that I met with during the day.

The 'Salto de agua' is a cold cascade /p. 140/ in the river Tapic, where the whole body of water has an uninterupted fall of 98 feet. The roar of the water when close to the Cascade, the

mist flying over it and the surrounding objects which are very picturesque, affects the mind with a pleasing astonishment, and detains the Spectator in a voluntary bondage.

The City of Tapic stands in a hollow upon the border of an extensive fresh water marsh, which might have easily been avoided without any local disadvantage for had it been but a quarter of a mile nearer San Juan it would have insured a dry foundation for it, as well as removed it from the malaria always attendant upon marshy land. There is nothing worthy of notice in the City, the ground plan being the same as in all Spanish America. The Plaza is neatly laid out, with a fountain in the centre, and the area surrounded by a row of trees, which overhangs a promenade with its stone benches, which are much frequented in the Evening;

There is a good market which is in general much frequented by visitors for the sake of seeing the Indians from the interior in the dress peculiar to their respective tribes. /p. 141/.

The esculent roots are very small, perhaps on account of the volcanic qualities of the Soil. – Good crops of Maize and wheat are raised in the neighborhood, and a spirituous liquor called "Mescal" is distilled from the roots of Agave Mexicana.

The population according to the Register kept here is 8000 and the deaths 1 in 25. Captain Belcher told me that he would be ready to start for San Blas on Saturday the 3d and accordingly at 3 AM. the horses were brought to the door. I attended and saw my specimens carefully placed upon the luggage horse, and in a few minutes we were all mounted. The morning was dark and but for occassional twinkling of a solitary star, not an object was to be seen. – With the break of day we put our horses to a round trot, and by sun rise we were crossing the bare topped mountains surrounded by scenery of the most romantic kind. The hills re-echoed the melodious songs of the birds–squirrels and monkeys leaped joyously from tree to tree either for amusement or in quest of food–the peasants hummed [?] their 'Ave Maria' and all the Creation seemed to rejoice in the return of day. Occassionally /p. 142/ an Equestrian pranced past us on his gallant stead [sic]–careless of the world and its concerns and puffing a cigaretto with the most perfect 'Sang froid' invariably bestowed the usual salutation of 'Adios Señores' and then resumed his easy posture. We met with few female travellers a circumstance which we must regret since it is not every day an Englishman sees a Lady honouring each side of the horse with a pretty foot and ancle, deffended by a huge pair of iron spurs, only equalled in sharpness by the wit and vivacity of the wearer.

Our mornings ride furnished us with a tolerable appetite for breakfast and on that account the sight of Doña Manuela's house was rather welcome. Breakfast was soon ready and our hostess regreted much that our stay was so short, and thinking no doubt that there was little chance of our returning that way again, charged us more than double for our breakfast, no doubt considering that the most beneficial mode of taxing [. . .] us. I botanized here 2 hours while the horses were feeding, after which we set out for the unenviable Port of San Blas, which may aptly be called the Purgatory of the /p. 143/ Pacific, for there is no place in the world less free from Comfort, or more infested with annoying insects than this.

My collection claimed my attention on board immediately upon our arrival in the Port and on the 5th we sailed for a cruize outside until the 8th when we took our departure for the Sandwich Islands.

[The expedition made the island of Hawaii on the 7th of July, 1837. They returned to the North American coast at the end of August, and spent September and part of October in the Alaskan region. After a stay in California they continued southward, and reached San Blas for the second time, on December 20, 1837. The journal continues: /p. 201/]

We made the 'Tres Marias" on the 18th and at length after considerable trouble in searching for anchorage, we espied the object of our pursuit on the north side of Saint Georges island.

These 3 islands called 'three Marys' by the Spaniards, are situate about 50 miles off the western coast of Mexico, and are all well wooded, but difficult of water in the dry season. I landed upon the island of Saint George, where I had an opportunity of botanizing for a few hours, but did not find many plants in flower.

The land birds are very tame & suffered themselves to be caught by the hand. The landing is dangerous on account of the myriads of ground sharks which are constantly lurking about the shore. The tiger Shark /p. 202/ is also very abundant, but does not come in to so shallow water as the other, but too much caution cannot be used in landing or allowing men to wade off to the boat. – We sailed the evening of the 19th for San Blas, where we arrived the following day to await the arrival of the English mail; but the Captain unwilling to lose time, determined to Survey a part of the Coast to the Southward, rather then remain in the miserable Port.

I was landed on the 21st with permission to remain until the 26th and the Sulphur sailed upon a surveying cruize down the Coast.

I employed myself between San Blas and Navarette–a place about 35 miles distant from the Coast, and notwithstanding that the Country was very dry I made a good many additions to my

former collection from this place, and returned on board of the Ship on the 26th according to order, and lost no time in putting my collection to rights; & as the Mail had not yet arrived, requested farther leave – Dr. Sinclair did so like wise which we obtained until the arrival of the Mail from England via Mexico. We set out the same day for the Mountains of Tepic /p. 203/ and by dint of spurring reached the City the same night.

I pursued my researches in the neighborhood until the 1st of Jany [1838] with very good success and added 130 species of plants to my former collection from this place. The high mountain ridges of San Juan afforded me many very interesting plants, but few seeds.[1]

Everything was packed up in traveling order on the evening of the 1st and as the Mail had arrived I directed the guide to bring the horses by 4 am. on the 2d which strange to say he did punctually! and it is difficult to get a Spanish servant to keep his word. The Dr. and myself again set out for our journey. I dismounted at day light–gave my horse to the guide, and Botanized to the half way house where we arrived in the evening.

After supper we lay down upon a hide [?] stretched out upon four posts, and passed the night as we best could, and set out for San Blas at 3 am on the 3d where we arrived in time for breakfast. –

The Sulphur was just come into harbor again and a boat was sent on shore to enquire about the Mail &c so that we had an opportunity of embarking soon /p. 204/ after our arrival and as there were no dispatches for Captain Belcher, he made sail as soon as the sea breeze set in and by sun set we were a considerable way down the Coast on our way to Acapulco.

[The Sulphur reached Acapulco on January 12 and stayed there until the 19th; she passed slowly down the coast of Central America, came to Cocos Island on April 4, and Callao on June 3. The return voyage began on August 6; the expedition reached Panama on October 18, 1838. End of Vol. I.]

[For nearly six months the Sulphur explored the Central American coast. On April 8, 1839 she left for the Hawaiian Islands. On June 17 she left Hawaii for the Alaskan Coast, where she spent a part of the summer. Gradually working her way south, she was at San Diego on October 16, at Cabo San Lucas on November 21, heading for San Blas. The journal resumes (Volume 2, p. 144)] :

As we only remained a few hours at San Blas there was little time lost by our trip there for on the 26th [November 1839] the Sulphur was anchored in the port of Mazatlan in the Gulph of California, where we found the Actaeon a Liverpool vessel, by which I sent some of my collections to England.

Mazatlan lies in 23°10′ north latitude, longitude 106°-21′ west. The anchorage is lined [?] upon either side with small islands, which /p. 145/ gives an air of gaiety to the sceenery, but the South East gales so prevalent from June to December and the shallowness of the water for two or three miles off Shore Counterballances every thing. The rainy season is said to Continue through July August & Sept some times Octr & November may be added to the list as was the case this year. During our stay a great deal of rain fell, and some sickness prevailed among the poorer inhabitants who were exposed alternately to the sun and wet. Like San Blas it is terribly infested with marshes in the neighborhood and at times it is by no means an enviable place.

The population fluctuates from 2000 to 7000. Captain Belcher gave me permission to go from this place to San Blas by land but limited me to 'Ten days' when he would be at that place in the Sulphur, but upon making the necessary inquiry on shore I was obliged to relinquish every idea of attempting it for these reasons. In the first place the distance by the road is 405 miles and the expenses exclusive of my food would have been nearly 200 dollars or £40 Stg which was much more than such a journey /p. 146/ performed in the face of time Could be worth for botanical purposes and in justice I was obliged to relinquish it. –

I packed two Boxes of dried specimens of plants for the Royal Gardens–Chiefly Collected in 1837 and shipped these on board the Actaeon of Liverpool–George Fielding Master, and would have been glad to have sent all my collection Could I have obtained boxes, but in that very important object I was dissapointed. My time was employed during our stay here in collecting in the Neighboarhood and writting. The vegetation was luxuriant but a scarcity of f[l]ower & fruit, and in Consequence of the wet weather I brought very little away from the Port of Mazatlan to show that I had been there. I have also to provide myself with a fresh supply of Stationary and Brown paper for drying plants, and last though not least–to renew my wardrobe which had dwindled almost into nothing during a four years voyage notwithstanding the sums which I have expended

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[1] [In the third volume of Barclay's journal, under date of January 1, 1841, there is the following entry: ". . . the 1st of January 1838 I was busy botanizing on the top of Mount San Juan in Mexico, at an elevation of 6000 feet. . . ."]

upon it since leaving London. Few people are more unfortunate than voyagers in this respect. Upon two occassions I have lost everything belonging to me–the Expence and difficulty of replacing them /p. 147/ is truly vexing–ten prices would not induce a Spaniard to go one jot out of his way.

The Stores being all on board we sailed on the 3d Decr to water at San Blas, as Mazatlan has no very accessible watering place. Several American Gentlemen going to the United States overland from San Blas took a passage in the Sulphur took a passage to the Port of our destination where we anchored on the 4th.

Captain Belcher and several of the officers set off for Tepic, and as I had been so fortunate as to procure another box, I in the first place finished packing it: in order that it might be forwarded by H. M. S. Fly at this time at Guaymas in the Gulph of California taking treasure on board for England but would call at this port upon her return for the 'freight' as it's called. The Chest or Box contained Six bundles of plants Collected at Cocos island–Panama–Libertad–San Blas–Tepic and Acapulco. – Also sections of tree Fern from the island of Tumaca–Pandanus fruit & 2 pieces of native Cloth from the Sandwich islands–9 spms of wood from Central America & Equinoctial Do. Pine Cones from–California–Columbia River– & Sitka and Lichens from Central America. /p. 148/ The chest was adressed as usual to W. L. Aiton Esqr and left in charge of Señr Don Frs^{o} Castillo Consular Agent in San Blas, and I further took the precaution to write to Fran^{s} Barron Esqr H. B. V. [?] Consul requesting that the same might be forwarded to England by the Fly–failing that by the first eligible opportunity. – I wrote also to Mr. Aiton informing him of the same & of my proceedings generally as Connected with my mission. –

These several affairs occupied a good deal of my time here which however I Could hardly have employed to greater advantage as the Season for Botanizing was unfavourable upon the low land and the expense of going to the mountains more than a day or two was worth especially as I had seen the productions, at an elevation of 6000 feet at two different seasons of the year viz June & January as well as those in this vicinity.

We sailed from this unenviable place on the 21st [December 1839] and finally bad adieu to the Western Coast of America, where if we had many unhappy days, we had a very healthy and Expensive station for four years. A new sceene now lay before us; it was indeed the Commencement of a second voyage.

[The Sulphur, heading for the South Pacific, crossed the Equator on January 14, 1840. She reached the Marquesas in the same month, Tahiti in April, Fiji and New Hebrides in June. End of Volume 2.]

[Volume 3 begins in the New Hebrides, June 23, 1840, and continues via New Guinea, July and August; Borneo, Amboyna, and Macassar, September; Singapore, October; Coast of Africa, December 9; Cape of Good Hope, December 15; England, February 14, 1841.]

Barkley, Fred Alexander. See Rowell, Chester M., Jr.

Barnes, Charles Reid (1858–1910). With William Jesse Goad Land (1865–1942), also of the University of Chicago, Barnes made an expedition to the American tropics in the fall of 1908. The two men worked for several days in company with C. G. Pringle near Guadalajara and near Etzatlán. Their itinerary for this period, as set forth in Pringle's published diary (Davis, 1936, p. 247), is as follows: between Atemajac and the upper part of the Barranca of Ibarra (September 26); Río Blanco and the Sierra de San Estéban (September 28); Falls of Juanacatlán (October 2); Barranca of Ibarra (October 3); trip to Etzatlán (October 5); mountains above Etzatlán (October 6); return to Guadalajara (October 7).

Barnes and Land, according to Pringle, "returned to Guadalajara" while he kept on to Mexico City. They joined him at Mexico at least by October 13, but in the meantime made a trip south by rail from Guadalajara at least to Tuxpan, where they collected along the railroad on October 9 (at least nos. 321–337). Their numbers for their entire stay in Jalisco, as far as I have been able to learn, run from no. 135 (*Oplismenus hirtellus*, collected in the Barranca de Oblatos, Sep. 25), to 337. The original set of their collections is in the Field Museum, Chicago (F), where it is listed in the accession records beginning with volume 46, page 84, and continuing at intervals through volume 57, pp. 572ff. The collections of 1908, including many bryophytes, totalled 617 numbers.

Beaman, John Homer. In connection with studies on high-altitude vegetation in Mexico and Central America, Professor Beaman ascended the Nevado de Colima in 1958. He collected nos. 2349–2388, on August 26 and 27, mostly at or above timberline. His specimens are deposited at Michigan State University, East Lansing (MSC).

Beechey, Captain F. W. The first large botanical collection in Nueva Galicia (if we except that made by the Royal Botanical Expedition to New Spain) was that made during the winter of 1827–1828 by the naturalist and the officers of H. M. S. Blossom. The Blossom lay in the harbor of San Blas from December 8, 1827 until some time the following February. George Tradescant Lay (–1845), the naturalist of the expedition, during this time "visited and remained for a long time at Tepic," and presumably collected most of the plants secured by the expedition. The ship's surgeon, Dr. Alexander Collie (–1835), is credited with some of the collections, and the officer in charge of the voyage, Capt. F. W. Beechey, has often been cited as the collector of individual species. Actually, it would appear that most of the specimens were secured by Lay, either near Tepic or at the nearby village of Jalisco. Officially, however, all the botanical specimens taken in the course of the voyage of the Blossom seem to have been handled by Captain Beechey, and transmitted by him to Sir William Hooker who, with G. A. Walker Arnott, published "The Botany of Captain Beechey's Voyage" (pp. 1–485, *pl. 1–99.* 1830–1841). On the title-page of this publication principal credit is expressly given to Messrs. Lay and Collie for the collection of the plants on the entire voyage, and an acknowledgment is made to Captain Beechey, "under whose auspices, and by whose zealous encouragement, the plants . . . were chiefly collected." On p. ii, the following statement appears (with no special mention of Captain Beechey): "The Botanical Collections were made by Mr. Lay the Naturalist, and by the officers of the ship generally; but in particular by Mr. Collie, who, during the temporary absence of Mr. Lay, zealously undertook the care of the department with which that gentleman was entrusted, and whose notes, as well as those of Mr. Lay, have been of much service in drawing up the following account." All this suggests that Captain Beechey, although encouraging and assisting the naturalists, took little if any active part in the collecting. In spite of this, doubtless because of Beechey's part in transmitting the collections to Hooker, his name appears on perhaps a majority of at least the Mexican collections, the principal set of which is in Hooker's herbarium, now at Kew. Many, if not most of the specimens bear simply the notation "Mexico, Beechey" in Hooker's hand, and only occasionally is a specimen credited to Lay or Collie.

Approximately 325 species, of which about 70 were new to science, were listed by Hooker and Arnott from Tepic or from the nearby village of Jalisco (which because of a mis-interpretation of some hand-written notation they always spelled Talisco). The list includes a representative proportion of the winter flora of the foothill country around Tepic. The collection as a whole remains the basic one for the study of the plants of this part of Mexico, in spite of a series of mixtures of specimens which occurred before the plants were studied. The authors noted (p. 275) that "there seems to have been a considerable mixture of the specimens collected at Loo Choo and Bonin with those of Mexico, the same species occasionally occurring in both packets." They mentioned the discovery of what they took to be two Asiatic species among the Mexican collection, and also cited (p. 276) the Asiatic *Corydalis ambigua* from "Talisco."

In addition to the species which they suspected of having been misplaced, various other Old World species were attributed by them to Mexico; these include *Sesbania tomentosa* (habitat given as Acapulco, but now recognized as a Hawaiian species), *Leptopetalum mexicanum,* of the Rubiaceae (described as a new genus presumably

from Tepic, but now thought to be a species of *Hedyotis* from the Bonin Islands), and *Lysimachia glaucophylla* (described as presumably from Tepic, but probably from the Bonin Islands). Furthermore, incomplete labelling of undoubted Mexican species has caused such anomalies as the report of maritime species (*Rhizophora mangle, Avicennia tomentosa*) from Tepic. Distribution records based on this collection should be used with discretion if they appear in any way unusual.

For notes on the state of the vegetation in the vicinity of Tepic at the time of the Blossom's visit, and on the routes between Tepic and San Blas, see in the present paper under Barclay. The principal route and presumably that pursued by the botanists of the Blossom, ran northeasterly from San Blas, skirting the highlands as far as Huaristemba, where it turned easterly as far as Navarrete. Here it turned more toward the south, and followed up a stream-valley to approach Tepic from the north-northwest.

Beetle, Alan A. See California, University of.

Blanco, Luciano. A resident of Guadalajara, said by Munson to have discovered a species of *Vitis* in the "Sierra Madre Mountains" (Gard. & For. 3: 474. 1 Oct 1890).

Bonisteel, W. J. See Gilly, Charles L.

Bourgeau, Eugène (1813–1877). A collection by Bourgeau is reported from Zacoalco, Jalisco (Contr. U.S. Nat. Herb. 17: 283. 1913). Bourgeau was the best-known of the collectors who were associated with the French Scientific Commission to Mexico, 1865–1866 (Biol. Centr. Am. Bot. 4: 136. 1887). Most of his collections were from near Mexico City, and these include others from Zacoalco, which is stated to be "near Mexico" (Biol. Centr. Am. Bot. 1: 388. 1880). Evidently the reference to Zacoalco, Jalisco, is an error.

Breedlove, Dennis Eugene. In January 1965 Dr. Breedlove collected on Cerro Sangangüey. His specimens are at the California Academy of Sciences (CAS), with duplicates at the University of Michigan (MICH).

Burnett, ————. Collected oaks on "Cerro Grande," Jalisco, at elevations ranging from 2000 to 2600 meters, in 1913, according to Trelease,[1] who cites four species from this locality (*Quercus candicans, colimae, panduriformis,* and *rossii*). The type of *Q. colimae* Trel. is a Burnett specimen said to be in the Herbarium of the U.S. Forest Service. The late Dr. Wm. A. Dayton informed me some years ago that none of the specimens cited by Trelease could be found in that herbarium, or in the U.S. National Herbarium, to which many dendrological specimens were returned by the Forest Service after G. B. Sudworth's death in 1927.

The location of "Cerro Grande," is uncertain but very probably this name refers to the massif of the Nevado de Colima, on which all the cited species are known to grow.

California, University of. Expeditions to the Andes, sent out by the Botanical Garden of the University of California, Berkeley, touched at Manzanillo on at least three different occasions. The following data on their collections were furnished by Dr. T. H. Goodspeed, through the kindness of Miss Annetta Carter. First Expedition: September, 1935, 25 collections by James West (nos. 3501–3512, 3514–3515, 3521–3522, 3524–3531, 3533). Second Expedition, August, 1938, 13 collections by Carleton R. Worth, Ovid B. Horton and John L. Morrison (nos. 8610–8622), and 26 collections by Walter J. Eyerdam and Alan A. Beetle (nos. 8701–8725, 8746); May, 1939, 26 collections by Eyerdam, H. E. Stork, Morrison and Horton (nos.

[1]Mem. Nat. Acad. Sci. 20: 63, 175, 180, 204. 1924.

25184–25200, 25401–25409). The principal set of these collections is at Berkeley, in the University of California Herbarium (UC), and duplicates have been distributed to various institutions in the United States and in Europe.

Carter, Annetta. In March, 1959, Miss Carter and Francia Chisaki collected in the vicinity of Puerto Vallarta and near Quimixto. Their collections were numbered 1177–1268 (in Chisaki's series) but were distributed under the names "Carter and Chisaki." The principal set is in the herbarium of the University of California (UC).

Castañeda, Alfonso Manuel. Author of a flora of Jalisco; see Leonardo Oliva.

Castillo, Juan de (1774–1793). See Sessé.

Castillo, M. S. del. Collected cytological material for Dr. L. O. Gaiser, q.v., at El Colli and other localities west of Guadalajara, and near Tequila, in 1950 and 1952.[1]

Cerda, Juan de Dios Vicente de la. One of the artists attached to the Royal Botanical Expedition to New Spain. See Sessé.

Charette, Leopold. See Weber, William A.

Chisaki, Francia. See Carter, Annetta.

Clarke, Oscar F. In two winter excursions from southern California to western Mexico (1967–1968, 1968–1969), Clarke and his students collected several hundred herbarium specimens, including several from the vicinity of San Blas. The first set is in the herbarium of the University of California at Riverside (UCR), and numerous duplicates are at the University of Michigan (MICH).

Collie, Dr. Alexander (–1835). See Captain F. W. Beechey.

Collins, Guy N. (1872–1938). Guy N. Collins and James H. Kempton (1891–), botanists of the U.S. Department of Agriculture, travelled in Jalisco in 1921 and in Nayarit and Jalisco in 1923. Their primary interest on these journeys was in corn and corn relatives, including *Tripsacum.* They collected some herbarium specimens, which are in the U.S. National Herbarium. Through the kindness of the late Dr. S. F. Blake I had access to some of the field notebooks kept by Collins and Kempton on these two trips, and the following account has been reconstructed chiefly from these notebooks.

In 1921 these investigators came by train from El Paso to Mexico City. After some work in Veracruz early in October, they went by train to Guadalajara, which they reached October 12; they went at once by train to Ciudad Guzmán, and returned to Guadalajara on October 14; they collected in the Barranca de Oblatos on the 15th, and went to Chapala on the 16th and San Pedro on the 18th. They were at Cocula from October 19 to 21, at La Vega (the railroad junction east of Ameca) on the 22nd. On the same day they passed through Etzatlán and went to El Amparo, a ranch some three kilometers to the south, where they worked a part of the following day, October 23. They returned to Guadalajara by train, and on October 24 visited Barranca de Ibarra, near the Experiencia cotton factory. On October 25 they were in Guadalajara, and on the 27th and 28th they undertook a second trip by train to Sayula and Ciudad Guzmán. Returning to Guadalajara on the 29th, they left for Mexico City on October 31, passing through Yurécuaro and Irapuato on this day.

In 1923 Collins and Kempton came to Tepic on the evening of September 30, by train from the north, via Mazatlán and Ruiz. They worked in the vicinity of Tepic for five days, making one-day trips out to Cerro de la Cruz (October 1), to Fresno

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[1] Rhodora 55: 259, 266. 1953.

(October 2), to Tecolote (October 3), and to Cerro de San Juan (October 3). On October 6 they started for Guadalajara by the usual road[1] through Ixtlán and Tequila. They reached Jala, near Ixtlán, on the 7th; Arenal, Jalisco, on the 9th; and on the 12th they were collecting in the Barranca de Oblatos, near Guadalajara. On the 17th they had passed on into Michoacán.

The specimens collected by Collins and Kempton in 1921 were not numbered, as far as I can determine, and I have not seen records of any from Jalisco except for the several collections of *Tripsacum* cited by Cutler in his monograph of the genus.[2] The collections made in 1923, however, were assigned serial numbers, and a list of these is preserved in Collins' notebook that deals with the trip of this year. A total of 97 numbers is listed, including grasses and other flowering plants, ferns, and mosses. Nos. 54–73 are from Mocorito, Sinaloa, and nos. 89–97 were collected after the botanists left Jalisco. The rest are from Nayarit and Jalisco, and are listed below:

Nayarit: Cerro de la Cruz, October 1 (1–28); Fresno, south of Tepic, October 2 (29–36); Tecolote, October 3 (37–51); Tepic, October 3 (74); Tepic, October 4 (53, 75, 76); between La Labor and El Ocotillo, October 6, (77, 78); Jala, October 7 (80); Jalisco: El Arenal, at kilometer 52, October 9 (79); Barranca de Oblatos, October 12 (81–88).

Kempton visited Nayarit again in 1931, and in 1940, but detailed records of the trips are not available, and I have seen no herbarium specimens collected in those years.

Contreras, M. Collected at Rancho Don Tomás, north of Manzanillo, in 1952 (An. Inst. Biol. [Méx.] 25: 116. 1954).

Cook, Stanton A. See Alava, Reino.

Córdoba M., ————————. See Muller.

Correll, Donovan Stewart. As an explorer for the U.S. Department of Agriculture, Correll visited many of the high mountains of southern Mexico in search of wild species of potatoes, in the autumn and early winter, 1947–1948. He left Washington, D.C., on October 15, 1947, and returned January 15, 1948. He reached Ciudad Guzmán on December 17. On the following day he went by automobile, via Atequizatlán and Sayulapa, to the village of El Izote, on the northwestern slopes of the Nevado de Colima. He ascended nearly to the snow-line by following up the water-supply conduits above the village, then returned to Ciudad Guzmán before night, with a few collections of potatoes (nos. 14340–14342, 14371). He spent December 19 and 20 in Colima, where he obtained some potato tubers in the markets (nos. 14343–14344 represent tubers purchased in Ciudad Guzmán; nos. 14345–14347 in Colima). On December 21 he planned to return to El Izote but found the road impassable; on this day he collected no. 14348 near Ciudad Guzmán, and nos. 14349–14370, mostly ferns, in a *barranca* near Atequizatlán. The next day, December 22, Correll drove from C. Guzmán, via Zapotiltic and Tamazula, to Jiquilpan. Two collections (nos. 14372 and 14373) were made at a place called La Llorona. The ferns were identified by the late C. A. Weatherby and are deposited at Harvard (GH); the flowering plants are in the Herbarium of the United States National Arboretum (USNA). For reference to the work of the U.S.D.A. potato expedition of 1947–48, the reader is referred to the several accounts by Correll.[3]

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[1]The railroad was not completed until 1927.

[2]Ann. Missouri Bot. Gard. 28: 262, 266. 1941.

[3]Correll, Donovan S. Wild potato collecting in Mexico. Field & Lab. 16: 94–112, illus. 1948; Collecting wild potatoes in Mexico. U.S.D.A. Circular 797: 1–40, illus. 1948; Section *Tuberarium* of the genus *Solanum* of North America and Central America. U.S.D.A. Agr. Monog. 11: 1–243, illus. 1952.

Cortina Rivas, Manuel. See McVaugh (1958).

Coulter, Thomas (1793–1843). An Irish botanist and medical man, Coulter lived and travelled in Mexico for about ten years. He was employed for a part of this period by the Real del Monte Mining Company, but had ample opportunity to make botanical collections. His specimens, estimated at 50,000 in number, were distributed after his death from Trinity College, Dublin. He seems to have been most active, botanically speaking, in the vicinity of Zimapán, Real del Monte, and Zacatecas, in all of which places he was employed for long periods. His collections in Nueva Galicia were relatively few, but the exact number is not known. Much information about his travels is contained in his diary, of which an account appeared some years ago.[1]

In December, 1825, Coulter made a trip from the city of Zacatecas to Bolaños, Jalisco, and returned to Zacatecas after a stay of about ten days at his destination. In spite of the lateness of the season he made a number of collections at Bolaños; at least a score of these are recorded in the literature, including the very distinctive *Bolanosa coulteri*, which was first known from his specimens. Some details of the trip from Zacatecas to Bolaños are known from his diary:

In response to an urgent letter from the mine superintendent at Bolaños, Coulter left Zacatecas the evening of December 12, to attend an employee who was stricken with a fever. In freezing weather (Coulter's thermometer stood at 12° F. when he reached Xeres at 4 a.m.) he travelled through the night and all next day, reaching Sta. María de los Angeles at 8 p.m. After a short night's sleep he started again at 5:30 a.m., and reached Bolaños by 8 p.m. on the 14th. The next item in his journal is undated:

> I have suffered a good deal on this journey; both from the speed & from a half cured bowel complaint & during my stay at Bolaños I was accordingly able to do but little more than attend to Martin [the feverish employee] who gets better.

After a series of compass-readings on various points around Bolaños, the journal continues:

> Decr. 25th at midnight—That I might not travel on a Sunday I spend the evening at a ball in the priest's & at midnight start on my return to Zacatecas—Mr. Auld [the superintendent] comes with me as far as Tlaltenango.

The return trip was easier than the hurried one out to Bolaños. Coulter apparently reached Tlaltenango on the 27th of December, and after a good rest left the following morning at 10. After "7 hours easy ride" he reached Colotlán, a distance estimated at 25 English miles. Thursday morning (the 29th), with hired horses, he went out to the north from Colotlán before sunrise to ascend a nearby elevation some 320 yards long, the Mesita de Sta. María, whence he could take compass bearings on various elevated points (on the south end of the Mesita his reading on the Santa María church was 72½°, and on the church at Colotlán 179°). After returning to Colotlán for breakfast, he set out for Villa Nueva, crossing the high ridge between, and reaching his destination in nine hours. The journal continues:

> It need not be more than 8 hrs were it not for the potreros which a conde de Xaral has had public spirit enough to establish on the natural line of road—damn the rascal!

From Villa Nueva the following day, December 30, Coulter reached Zacatecas after about nine hours' ride, travelling the line of the valley by way of the Hacienda de Malpaso.

A year later Coulter passed across the northeastern corner of Nueva Galicia in the course of a trip from Zacatecas to Zimapán. He left Zacatecas on January 15, 1827 and travelled generally southeastward as far as Sauceda, in the same state, then turned

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[1]McVaugh, Rogers. The travels of Thomas Coulter, 1824–1827. Jour. Washington Acad. Sci. 33: 65–70. 1943. See also a summary, based in part upon family letters and other documents, by Alice M. Coats, The Plant Hunters (pp. 341–344. McGraw Hill, 1970).

southward to Ciénega Grande, just within the borders of the State of Aguascalientes. The following day (Thursday, January 18) he reached Letras after seven and one-half hours' riding, and the day after this he reached Ojuelos, Jalisco, in six hours. Letras no longer appears on ordinary maps, but in Coulter's time it was a ranch about eight or ten kilometers northwest of Ojuelos (British Museum additional ms. 17659A, Mapa del Reyno de Nueva Galicia Año de 1812). Leaving Ojuelos on January 20, Coulter arrived in San Felipe, Guanajuato, on the 21st.

On this trip Coulter covered a distance (by his own reckoning) of 28 leagues from Ciénega Grande to San Felipe in four days. Ojuelos, which lies on this route, is on the high plateau of central Mexico, at an elevation of 2254 meters, in what is essentially an arid grassland; occasional rocky hills support a xerophytic shrub vegetation. In mid-winter practically all vegetation is dormant in this area, and it seems unlikely that Coulter collected any plants at this time.

Almost nothing is known of Coulter's life and activities from 1828 to 1831, and he may have worked during this period in the mining centers in Hidalgo, in Zacatecas, or elsewhere. At the conclusion of his work in central Mexico, however, he travelled widely in the northwestern parts of that country, and made extensive collections in Sonora and in California. His later travels are fully discussed in a paper by F. V. Coville (Bot. Gaz. 20: 519–531. *pl. 35.* 1895). After terminating his affairs in Zacatecas and Hidalgo, he apparently crossed Mexico in 1831, and took passage on a ship from San Blas to California. He was in Guaymas, Sonora, in August of that year. When he returned from California, probably in 1833, he seems to have crossed to Mexico City by the main route from San Blas. His plant-specimens labelled as from "San Blas to Tepic" or "San Blas to Guadalajara" are occasionally cited in botanical literature, and most probably were collected along the highway during his return trip from California. I do not know the exact number of collections made at this time, but more than 30 were cited by Hemsley in the *Biologia Centrali-Americana,* and the total may be somewhat more than this.

Cronquist, Arthur. See McVaugh (1962). Cronquist also visited Nueva Galicia in 1965 and 1970. His collections were mainly Compositae. The first set is in the herbarium of the New York Botanical Garden (NY). Duplicates of the 1962 collection, and a part of those of 1965, are at the University of Michigan (MICH).

Cruden, Robert W. In 1966, Cruden travelled in Mexico with Elwood Molseed (q.v.), and collected at least a few specimens in Nueva Galicia.

Crum, Howard Alvin. See Wilbur.

Cutler, Hugh Carson. While engaged in a field-study of the grass genus *Tripsacum,* and in studies of native agriculture, Cutler collected near Ciudad Guzmán and at a few nearby points along the roads and railroads. His collections here were made chiefly on October 9 and 10, 1940, and are numbered from about 4011 to 4118. The specimens were distributed to various herbaria, including those at St. Louis (MO), Harvard (GH), and Washington (US).

Deam, Charles Clemon (1865–1953). Deam collected at least a few specimens near Aguascalientes in 1898.

DeLeon, Donald. Collected herbarium specimens in Nayarit and Jalisco in 1957, in connection with taxonomic studies of plant-feeding mites. A partial set of the collections is at the University of Michigan (MICH).

Denton, Melinda Fay. Miss Denton travelled in Mexico in 1968 and 1970, primarily to collect material for a revision of *Oxalis,* sect. *Ionoxalis.* She collected briefly both times in Nueva Galicia. Her specimens are at the University of Michigan (MICH).

Detling, LeRoy Ellsworth (1898–1967). Professor Detling, then a member of the staff of the University of Oregon, gathered a few specimens in Nayarit in 1959, and collected about 100 numbers in Jalisco in 1965, but his more important plant-collections were made from July 1961 to May 1962, while he was engaged in a study of the plant communities of the Sierra Madre Occidental, with headquarters in Guadalajara. His collections in 1961–62 included nos. 8372–9018, of which about two-thirds were from Nueva Galicia and the rest mostly from Sinaloa and Durango. In 1965 he collected nos. 9487 -9587 in Jalisco. His more important collecting localities were near Guadalajara, where he took more than 150 gatherings, including about 70 from the *barrancas* near the city; Ixtlahuacán de los Membrillos (about 100 gatherings); San Juan Cozalá (about 30); *barranca* of the Río Verde between Tepatitlán and Yahualica (about 35); between Aguascalientes and Calvillo (about 38). Other localities included Tapalpa, Puerto Vallarta, and the vicinity of Santiago, Colima. The first set of the collection is at the University of Oregon (ORE), and partial or nearly complete sets are at the Instituto de Biología (MEXU), the University of Michigan (MICH), the University of Washington (WTU), and the U.S. National Herbarium (US). Some of the data from Detling's study, including lists of species making up several vegetation-types in Jalisco, were published in a posthumous paper.[1]

Dewey, Lyster Hoxie (1865–1944). The type of *Agave palmaris* Trel., said to be in the Missouri Botanical Garden (MO), was collected at "Mezetepec," Jalisco, by Dewey (no. 657).[2] Dewey, an employee of the United States Department of Agriculture, specialized in the study of plant fibers other than cotton, and traveled widely in Mexico to further this study.

Díaz Luna, Juan Carlos. Resident in Guadalajara, Biól. Díaz Luna has collected in Jalisco since 1967.

Dieterle, Jennie Van Akkeren. In 1963 Mrs. Dieterle accompanied Rzedowski (q.v.) and Feddema on a collecting trip in Mexico. Her collections included nos. 3000–3181. She made a second trip in 1969, collecting nos. 3407–3588, mostly specimens of Cucurbitaceae, in Jalisco and Colima (September 11–October 2). Her specimens are at the University of Michigan (MICH).

Diguet, Léon (1859–1926). Over a period of nearly 25 years (1889–1913), Diguet made seven trips to Mexico. His principal interests were in the fields of ethnobotany, anthropology, and geography. Most of his travels were undertaken in the interest of, and at the instigation of, the Muséum National d'Histoire Naturelle, Paris. His contribution to the flora of Nueva Galicia was a unique one, because he collected plants on three long visits to the territory of the Huichol and Cora Indians of the Sierra de Nayarit. Although Hartweg and Seemann had visited this part of the country briefly, and J. N. Rose subsequently, in the summer of 1897, passed through on a profitable collecting trip, no botanist other than Diguet seems to have spent more than a few days in this remote part of Mexico.[3]

Diguet's first travels in Mexico (1889–1894) were in Baja California. They were

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[1]Detling, LeRoy E. Historical background of the flora of the Pacific Northwest. Univ. Oregon Mus. Nat. Hist. Bull. 13: 1–57. 1968. (pp. 46–52 are entitled *Vegetation areas in western Mexico*).

[2]Contr. U.S. Nat. Herb. 23: 116. 1923.

[3]Carl Lumholtz worked among the Coras, and especially with the Huicholes, in 1895–1896, and again in 1898, but as far as I know he collected few plants. His work was in the field of anthropology. See *Unknown Mexico,* by Carl Lumholtz. 2 vols., Scribners, 1902.

primarily for geological and geographical exploration and resulted in various publications on the peninsula and its resources.[1]

Diguet seems to have returned to Paris from Baja California in January, 1895. The following March (1896) he was planning a trip to Guanajuato, Jalisco, Nayarit, Sinaloa and Sonora, and apparently he left Paris in May, 1896. He spent two months in Guanajuato, but collected little except minerals because of the prevailing drought. He passed the months of September and October in Guadalajara, where he collected numerous plant-specimens for the herbarium. This summer and autumn, for the only time in his career, his specimens were serially numbered in the approximate order of collection. The collections in Paris include approximately 200 numbers, of which two-thirds are from the vicinity of Guadalajara and the remainder from the "territoire de los huicholes," in the Sierra de Nayarit.

After the rains, which lasted until the end of October, Diguet set out on his first expedition to the Sierra de Nayarit. No details of his routes to and from the country of the Huicholes are known to me, but he stated that he began his work in the "northeastern part" of the area, and it seems probable that he went in from Guadalajara by way of Bolaños and Mezquitic. At least one collection (no. 107, *Phoradendron carneum*) is from the valley of Mezquitic according to the label. Another collection (no. 199, *Thevetia* sp.) is labelled as from the Barranca de San Cristóbal, north of Guadalajara, and may have been collected on the return trip from Bolaños. Unfortunately neither of the above is dated. A few of the collections from the Sierra de Nayarit are dated November, but the majority are dated December. Very few of the plants from this area are supplied with precise information as to locality; a few are said to have come from the eastern slope ("penchant oriental") of the Sierra de Nayarit, at elevations ranging from 2000 to 3600 meters. More than 30 numbers are labelled as from the "Sierra de los huicholes" or "territoire huichol." Two numbers only (nos. 135 and 146), as far as I have seen, are labelled as from specific localities: these are the Ravin de Kiteni, and the Ravin de Rhaïmota, neither of which appears on any map at my disposal.

Because of an "advanced season" and excessive cold in the mountains, Diguet was disappointed in his hopes of making large botanical and zoological collections in the Sierra de Nayarit, and returned to Guadalajara in December.

Soon after his return to Guadalajara, Diguet went on to Baja California, probably by boat, early in 1897. He was in or near La Paz until at least March 22, at which time he was preparing to return to Jalisco. He was collecting on the Cerro San Juan, near Tepic, in June, and he was in Guadalajara about the end of the year 1897, at which time he noted that he had finished his collection of plants.

Diguet seems to have collected very few herbarium specimens in Tepic—his assembled collections at Paris include fewer than a half-dozen from that place. Apparently he spent some days or weeks in the vicinity, however, either in 1897 or in 1900. He collected in June, 1897, either on Cerro San Juan or at Compostela, or both, specimens of a *Cnidoscolus,* the *chilte* of local fame, which was described in 1906 as a species new to science, *Jatropha tepiquensis.*[2] Some years later Diguet himself published an article on a tree which produces the *chilte* gum of commerce, and it would appear from his remarks on distribution, habit, habitat, and methods of exploitation, that he had spent a fairly long time in the field-study of the problem,

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[1]Cf. Rapport sur une mission scientifique dans la Basse-Californie. Nouv. Arch. Miss. Scient. 9: 1–54. *pl. 1–10.* 1899; also see various articles in Bull. Mus. d'Hist. Nat. 1: 4, 28–30. 1895; articles cited in pp. 7–8 of *Les Cactacées utiles du Mexique;* and his popular work, *Territorio de la Baja California Reseña geográfica y estadística,* pp. 40, illus., folded map, Librería Bouret, Paris & México, 1912.

[2]Costantin & Gallaud, Rev. Gén. Bot. 18: 391. 1906.

chiefly in the vicinity of Tepic where the plant is abundant.[1] In the same article Diguet states that the principal centers of collection of the gum are at Jalcocotán, Valle de Banderas, Mazatán, Hacienda de Santa Rosa, Hacienda de las Varas, Compostela, and the immediate vicinity of Tepic. Whether or not he himself visited all these localities is unknown.

I suspect, but cannot prove, that in the autumn of 1897 Diguet made an expedition, longer than his venture in 1896, to the western part of the Sierra de Nayarit. In the Paris herbarium is a series of approximately 135 plant-collections made by Diguet, completely lacking in identifying data except for a printed label which reads "Sierra del Nayarit, partie occidentale." Probably the collection was obtained at about the end of the rainy season, perhaps in August or September. Various Leguminosae, and Amaryllidaceae for example, are represented in the collection by specimens in early anthesis, as might be expected in these months. More specifically, such genera as *Minkelersia* (Leguminosae), *Anthericum* (Liliaceae), *Lobelia* (Campanulaceae), *Buchnera* and *Escobedia* (Scrophulariaceae), *Neogoezia* (Umbelliferae), *Triumfetta* (Tiliaceae), *Cacalia, Centaurea,* and *Cosmos* (Compositae), are characteristic members of the fall flora of the pine forests of the Jalisco mountains, and all are represented in the collection by flowering specimens.

I have suggested that this fall collection was made in 1897, partly because Diguet is known to have been in Jalisco both before and after the months in question, and is now known to have made other collections in this period. It is probable that the collection as a whole was made on one of his early trips to Mexico, because practically all of his later specimens, beginning with those from the Oaxaca-Puebla trip of 1902–1903, are supplied with the year and month of collection. Finally, this "partie occidentale" of the Sierra de Nayarit is the country of the Cora Indians, which Diguet apparently did not visit during his trip of 1896, or where at least he had no opportunity to collect in that year. His report on his mission to the Cora, however, was published in 1899,[2] and it seems most probable that his first long visit to the Cora was actually accomplished in the fall of 1897. In 1898 he was in France during the autumn months; in 1899 he was in Jalisco and could have visited and collected in the Sierra de Nayarit, but this seems unlikely not only because of the publication date noted above but also because of the known sequence of Diguet's activities in that year, when late summer rains caused him to return to San Luis Potosí and Zacatecas after beginning his work in Jalisco.

At the completion of his work in Jalisco in 1897 Diguet apparently returned once more to Baja California, for he was in La Paz on February 17, 1898. He was back in France in June of the same year.

The summer of 1899 saw the beginning of another expedition to Mexico. Diguet began work in Jalisco but because of the difficulty caused by the rains he spent some time in San Luis Potosí and Zacatecas before returning to Jalisco in the fall to complete a herbarium intended to supplement his earlier one. He was in Guadalajara and Ameca in December, and in the same region until near the end of January, when he was planning another trip to the Sierra de Nayarit. It was his intention to go from the Sierra de Nayarit to Mazatlán and Baja California before proceeding to Manzanillo and southern Jalisco. He is known to have been in the country of the Huichol Indians, in the eastern part of the Sierra de Nayarit, in March, 1900, and among the Coras, farther west, at various localities along the Río San Pedro, in April. He may have

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[1]Diguet, Léon. L'Arbre à chilte et son exploitation au Mexique. Rev. d'Hist. Nat. Appliquée 3: 237–249. *pl. II–III.* 1922.

[2]La Sierra du Nayarit et ses indigènes. Nouv. Arch. Miss. Scient. 9: 571–630. *pl. 1–11.* 1899. See also his Relation sommaire d'un voyage au versant occidental du Mexique. Bull. Mus. d'Hist. Nat. 3: 345–352. 1898, and Idiome Huichol, contribution à l'étude des langues mexicaines. Jour. Soc. Americanistes Paris 8: 23–54, illus. (map). 1911.

returned to civilization by way of Tepic, and carried out his plan to go on to Mazatlán from there. It is stated by Bois in his sketch of Diguet's life (Cact. Ut. Mex. 9) that during this expedition the traveler visited the states of San Luis Potosí, Jalisco, and Colima, and the Gulf of California.

In the Paris herbarium is a series of approximately 75 plant-collections made by Diguet, each accompanied by a printed label reading "Sierra du Nayarit (Territoire Huichol) Etat de Jalisco (Mexique)." Most are without other identifying data, but a few are dated March, 1900, and at least one (*Zanthoxylum* sp.) has the additional locality, "côte du Mezquitic." At least six collections are from definitely stated elevations (from 190 m to 900 m) along the Río San Pedro, and the labels on these have been changed to read "Territoire Cora," and the date is given as April 1900. Inspection of the plants in the collection as a whole strongly indicates that all the specimens were taken in the spring (dry) season. Such genera as *Cochlospermum, Bombax, Inga, Combretum, Chimaphila* and *Cercocarpus,* including members of both lowland and highland floras, are well represented in the collection in the spring condition.

The next (fourth) trip for the Paris Museum began late in 1902. Diguet was in Etla, Oaxaca, in December and in the State of Oaxaca at least until the end of January, 1903. Data on herbarium specimens indicate that during February and March he was in Oaxaca and also in Baja California; I suspect that the former only is correct. Late spring found him in Jalisco, but he seems to have collected few plants. In April he climbed the Cerro de Huejotitán, near the western end of Lake Chapala, and also botanized along the Río de Tuzpan, near the southern border of the state. In May he made a few collections in the Sierra del Alo [Halo], in southern Jalisco.[1] In June he was in Guadalajara, and about July 1 he moved to the region of Tehuacán, Puebla. He collected there and in other parts of the latter state until September; a much-collected locality in this last month was the Sierra Zacapoaxtla, on the northwestern borders of Puebla. In December Diguet was in La Paz, Baja California, planning to stay three months. In May, 1904, he was in San Blas, Nayarit; he probably returned to Paris in June or July.

Herbarium materials collected in 1902 and 1903 were considerable, especially those from Puebla and Oaxaca; these remain for the most part in Paris, unsorted and unidentified. There are fewer than 20 collections from Jalisco.

In 1907, from July to October, Diguet made a large collection of herbarium specimens, all as far as known in the State of Michoacán, and mostly in July and August on or near the Nevado de Toluca or in the Sierra Tlalpujahua. These, for the most part, remain unworked in the Paris herbarium. The collector himself was probably in Mexico until near the end of the year.

Little is known of the details of Diguet's last trip for the Museum (1911–1913), except that he apparently made his center of operations for the field-season of 1912 near the village of Huejotitán, Jalisco, northwest of Lake Chapala, and probably on the slopes of the mountain called El Viejo, which rises immediately above the lake to an elevation said to be 2960 meters. His botanical collections in this vicinity number approximately 160, of which about one-third were taken in July, one-third in October, and the rest in the months of May, June, August, November and December. Collections were also made in February in the Barranca de Tequila, and in the vicinity of Guadalajara in March, April, May, September and December. The total number of collections made in Jalisco is probably at least 200.

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[1] I have not been able to locate this range of mountains on any map, but the name is well known locally; see the gazetteer. There is a ranch called Alo, listed as in the Municipalidad de Tecalitlán, in Bárcena's index of populated places in Jalisco (An. Min. Fom. Rep. Mex. 9: 42. 1891).

From the meager data attached to herbarium specimens it appears that Diguet remained in Mexico for most of the following year, 1913. He was in Colima in April and May, in Guadalajara in August, and in Baja California in September.

The principal series of Diguet's herbarium specimens, comprising at least 1800 individual collections, is deposited at the Museum National d'Histoire Naturelle, at Paris (P). Through the kindness of the late Professor Humbert I was permitted in July, 1954, to sort the collection and extract the materials from Nueva Galicia; these latter, including approximately 700 collections, are in the process of study. Some few duplicates had already been distributed to herbaria in Europe and the United States. The remainder of the specimens, including most of the series from Baja California, Michoacán, Puebla and Oaxaca, remain unstudied and undistributed at Paris. Although the collections as a whole, and especially those from little-collected areas like the Sierra de Nayarit, are of much interest to botanists, many are unfortunately incompletely documented. The majority bear no date except for month and year, and even these may be wanting. Locality-data are often wanting except for the name of the State; approximately one-tenth of the known specimens from Jalisco, for example, are otherwise completely without data. Except for the collections of 1896 they are not serially numbered, so it is ordinarily impossible to deduce the place of collection when this is wanting.

Diguet's most important work was in ethnology and ethnobotany, and his continuing interest in these subjects led him to make numerous observations on the uses of plants in Mexico, and to the publication of several papers on the same subject. He was particularly interested in the cacti. His last work, the posthumous *Les Cactacées utiles du Mexique,* was published by the Société Nationale d'Acclimatation de France, of which he had been a member and officer.[1] A portrait of Diguet forms the frontispiece of this volume, and a sketch of his life and work, by D. Bois, comprises pages 7–12, inclusive.

Dodds, Donald. See Gilly, Charles L.

Dugès, Alfred Auguste Dalsescautz (1826–1910). A French botanist and entomologist who lived many years in Mexico, and whose botanical work was done chiefly in the State of Guanajuato, Dugès sent numerous botanical specimens for study to Asa Gray and Sereno Watson. The latter reported,[2] in a paper dealing chiefly with plants of northern Mexico, the occurrence of *Aristolochia pardina* in the following words: "At Colima, where it is known as 'Huaco' (Dugès)." This report was repeated by Hemsley, with the implication that Dugès actually was the collector of this plant at Colima.[3] There may be some confusion with the specimens of the same species collected at Colima by Ghiesbreght. As far as I know Dugès is not reported to have made other collections at Colima.

Echeverría y Godoy, Atanasio. One of the artists attached to the Royal Botanical Expedition to New Spain. See Sessé.

Eckfeldt, John W. (1851–1933). A list of lichens supposedly collected in Mexico by Dr. Eckfeldt, including seven species from Jalisco (without further locality), was published by Mueller Argoviensis in 1894.[4] It is implied that the collections from Jalisco, as well as others from Monterrey, Mexico, from Texas, from Hawaii, and from Bolivia, were made by Eckfeldt himself. Numbers assigned to the collections are those

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[1]Diguet, Léon. Les Cactacées utiles de Mexique. Arch. d'Hist. Nat. 4 [whole volume]: 1–551. figs. 136, frontisp. 1928.

[2]Proc. Amer. Acad. 18: 148. 1883.

[3]Biol. Centr. Am. Bot. 4: 84. 1887.

[4]Lichenes Eckfeldtiani a cl. Dr. J. W. Eckfeldt Philadelphiensi, praesertim in Mexico lecti, quos enumerat Dr. J. Müller. Bull. Herb. Boiss. 2: 89–93. 1894.

of Eckfeldt. It appears, however, from Harshberger's account of Eckfeldt's life,[1] and from the biographical sketch published by Witmer Stone,[2] that Eckfeldt did not engage in extensive explorations, but rather increased his herbarium of lichens through correspondence. It is probable that the collections from Jalisco were obtained by someone other than Eckfeldt, and turned over to the latter for identification.

Edmondson, J. See Powell.

Ehrenberg, Carl August (1801–1849). Occasional records in literature refer to specimens collected by Ehrenberg or by C. J. W. Schiede at Encarnación, "Jalisco."[3] This locality is actually in Hidalgo, where both these men made large collections. As far as known neither worked in Jalisco.

Eisen, Gustavus Adolphus (1847–1941). Collected a species of *Ficus* at "San Juan near Tepic" in September, 1894.[4] Eisen was an entomologist and naturalist with the broadest interests. For some years he was concerned with figs and the subject of caprification.[5]

Eiten, George. See David P. Gregory.

Ellison, William Lee (1923–1971). In connection with studies on the genus *Bahia,* Ellison travelled in Mexico in 1960 and collected a few specimens in Nueva Galicia.

Elmore, Francis H. The Allan Hancock Pacific Expedition, in the *Velero III,* touched at Tenacatita Bay, Jalisco, on May 8, 1939, and Elmore, the botanist of the expedition, collected nos. 1A1 to 1A24, comprising approximately 90 specimens, of land plants. The locality is discussed, and species are listed, by Howard Scott Gentry, in his report on the land plants of the Hancock Expeditions.[6] The specimens are preserved at the University of Southern California (USC); a duplicate set is at the University of Michigan (MICH).

Emrick, George Monroe (?1852–1906). A Chicago physician whose name was also spelled Emerich or Emerick, who received his diploma from the Chicago Medical College (later the medical school of Northwestern University) in 1873, Emrick died in Chicago December 12, 1906, very soon after his return from Mexico. According to Brand (1960, p. 229) he was probably interested in investing in agricultural lands in southwestern Mexico, and for this reason made several trips to Hda. Coahuayula. His specimens became the property of the Field Museum, Chicago (F). According to the Museum's records, kindly searched for me by Dr. Julian A. Steyermark, the herbarium received 557 specimens collected by Emrick. Apparently he used more than one set of collection-numbers. His numbers 1–229, all or nearly all obtained at Hda. Coahuayula in February, 1901, are listed in Vol. 24, pp. 174–195 of the Museum records. He also made a collection at Paso del Río, Colima, in November, 1906; these are independently numbered from 1 to at least 211. Brand also mentions herbarium specimens from Coahuayana and from Ostula, but I have not seen any of these.

Erlanson, Carl Oscar. Erlanson and Max J. Souviron, explorers for the United States Department of Agriculture, made some botanical collections between December 31, 1930, and January 6, 1931, in the *barrancas* near Guadalajara, and in the vicinity of Chapala. The specimens are in the United States National Herbarium (US). The

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[1] Harshberger, John W. The botanists of Philadelphia and their work. pp. 356–358. 1899.
[2] Bartonia 15: 57–59. *pl. 4.* 1933.
[3] Contr. U.S. Nat. Herb. 23: 1085. 1924; Pflanzenreich IV. 251 (Heft 59): 66, 67. 1913.
[4] Contr. U.S. Nat. Herb. 20: 11. 1917.
[5] Essig, E. O. A history of entomology. pp. 615–617. 1931.
[6] Allan Hancock Pacific Exped. 13, pt. 2: 182–192. 1949.

principal work of the expedition was the investigation of *Ceiba acuminata* as a possible fiber plant, and the location and collection of wild potatoes; no general botanical collection was attempted. The names of the collectors may appear on the labels in either order, but usually as "Souviron and Erlanson"; at least one specimen has been reported in literature with the collectors' names given as "S. & E." (Rhodora 41: 355. 1939). Souviron was a horticulturist and most of the botanical collections were made by Erlanson.

Estrada Faudón, Enrique. A physician of Guadalajara, who has long been interested in the plants of Jalisco. See McVaugh (1965).

Eyerdam, Walter J. See California, University of.

Feddema, Charles. While a graduate student at the University of Michigan, Feddema collected in Mexico in 1958 and 1959 (with King, q.v.), in 1960 (with McVaugh, q.v.), in 1961 (in company with Don Francoeur), and in 1963 (with Rzedowski, q.v., and Mrs. Dieterle). The first set of his specimens is at the University of Michigan (MICH). After collecting in Oaxaca in July 1959, Feddema and King came to Michoacán early in August. The joint collections for the rest of the season were assigned Feddema's numbers, 1–1135. Major collections were made on Cerro Santa María (nos. 1–251, August 5–9), vicinity of Ahuacatlán and Tetitlán (nos. 252–534, August 11–15), southeast of Tepic, especially on and near Cerro Sangangüey and above the lake near Santa María del Oro (nos. 535–792, 914–954, August 16–20, August 24), north of Tepic, especially near Puga and near the Mirador del Aguila (nos. 793–913, August 21–22), on the road to Miramar and San Blas (nos. 955–1027, August 25–26), and toward Compostela, Mazatán, and Las Varas (nos. 1028–1135, August 27–29).

On Feddema's trip to Jesús María in 1960 he flew in a private plane from Tepic on September 17. The pilot put him down on the plateau above the village, and he went by mule to Jesús María and lodged there while collecting in the dry woodland, dominated by cacti and *Bursera,* in the river-valley (nos. 1200–1338, 1448–1465, September 17–20, 22). On September 20–21 he made an excursion into the hills east of Jesús María, where he collected nos. 1339–1447, mostly in the oak zone on the western slopes of the Sierra de los Huicholes. He returned to Tepic on September 24.

In 1961, while gathering material for a revision of the genus *Sclerocarpus* (Compositae), Feddema began work in Texas late in July, passed into eastern Mexico, reached Nueva Italia and the vicinity of Apatzingán about August 15, then continued rapidly via Uruapan, Zamora, Guadalajara, Plan de Barranca and Tepic (August 16–19), and on to Sonora. He collected approximately 70 numbers (at least nos. 1707–1775) in western Michoacán, Jalisco, and southern Nayarit.

In 1963, while traveling with Rzedowski (q.v.) and Mrs. Dieterle, Feddema collected independently, nos. 2119–2742. His localities were in the Sierra de los Corales (nos. 2119–2226, October 22–25); near Gallardo (2227–2243, October 26); Puerto de la Paja (2244–2268, 2320–2331, October 30, November 1); Rancho Viejo, Arroyos del Agua, San Antonio, and elsewhere near Huejuquilla (2269–2319, 2332–2380, 2396–2401, October 31–November 3); Tanque de los Rayos (2383–2395, November 3); Cerro Colorado, El Mortero and elsewhere near Mezquitic (2381–2382, 2402–2480, November 3–5); near Monte Escobedo (2481–2482, November 6); vicinity of Puerto Vallarta (2483–2603, 2610–2614, November 11–17); near El Cuatante (2603A–2609, 2615–2652, November 17–18); near La Cucaracha (2653–2657, November 19); west of Mazatán (2658–2672, November 20); Rancho Chila (2682–2712, November 23); Cruz del Campo (2713–2729A, November 24); 2–3 km north of San Juan de Lima (2736–2742, November 25); Coahuayana, and along the road to Colima from Tecomán (2732–2735, 2730–2731, November 25). The next collections were in Guerrero, November 30.

Fernow, Bernhard Eduard (1851–1923). Two species of oaks collected by Fernow "near Colima" are reported by Trelease (Mem. Nat. Acad. Sci. 20: 180. 1924). Fernow did private consulting work in forestry, particularly in the period 1903–1907,

during which time one of his projects was the investigation of an "oak property of the Sierra Madre" near Colima. Rodgers states that the same property was investigated in the spring of 1913 by H. N. Whitford; perhaps the same area was under consideration by one Arthur Wood of Colima, in November 1909, as a possible site of a planned forestry project.[1] Areas near Colima suitable for growth of oak and pine were almost certainly on the slopes of the Nevado de Colima above the city, but I have no definite information about the area visited by Fernow.

Ferris, Roxana Stinchfield. With Mrs. Ynez Mexia, Mrs. Ferris (then of Stanford University) collected in Sinaloa in September, 1925, then came alone to San Blas, Nayarit, by boat. After exploration of the Tres Marías Islands, she returned to San Blas, walked to Tepic via Jalcocotán, collected around Tepic and the nearby village of Jalisco, went to Guadalajara by automobile and mule and thence to Manzanillo by train. She made large collections (about 650 numbers), the principal set of which is in the Dudley Herbarium, Stanford University (DS); a duplicate set is in the National Herbarium (US). A summary of dates, localities and numbers, kindly supplied by Mrs. Ferris, follows:

San Blas, October 1–18, 1925 (nos. 5301–5562); San Blas to Jalcocotán and Tepic, October 31–November 1 (5672–5769); Tepic, November 2–18 (5770–5810, 6001–6016); Jalisco, Nayarit, November 8–12 (5811–6000, 8023); toward Ixtlán, 20 miles from Tepic (6018); Manzanillo, Colima, November 27–December 2 (6019–6248).

Forman, Michael. See Straw.

Furness, Dwight R. The herbarium of the Field Museum (F) contains approximately 104 specimens, collected in Mexico in 1909. These bear a printed label giving the year but no additional information about the date of collection, and giving the collector's name as Dwight R. Furness. A specific locality of collection appears on most of the labels. The specimens were apparently sent to the Museum as a gift in return for identification, and are entered in the records of the Museum under Accession 1414 (specimens 251313–251325) and Accession 2260 (467611–467701).

Most of the specimens are labelled as from Guanajuato; an undetermined number are from Guadalajara or from Ocotlán, Jalisco (in one case cited in literature as "Ocotlari"). I have not been able to learn anything more about the collector or his work in Mexico.

Gadow, Hans (1855–1928). A zoologist from the University of Cambridge who had spent the summer in Mexico, Gadow came to Zapotlán by train in mid-September, 1904, accompanied by Mrs. Gadow. Their purpose was to see the volcano, which had erupted in a spectacular manner only the year before, and to study the reptiles and amphibians in the vicinity. They took horses for the trip, and camped the first night at 6600 feet, five hours from Zapotlán, near a spring at a ranch above the hamlet of Las Canoas. They spent a day trying to ascend through the heavy forest of the waterless east side of the Nevado, then retraced their steps, learned of the waterline which affords an easy passage around the northeastern shoulder, and followed this to their camp, near a water-tank at 9,500 feet. [It is possible that this tank was the Canoa de Leoncito which about 1952 marked the extreme upper limit of travel with a wheeled vehicle–RMcV]. The route toward the summit of the Nevado, as described by Gadow, led him up into the interior basin of the mountain, where the peak as seen from the north "rises there like the Matterhorn." [This must have been near the shelter at La

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[1]Rodgers, Andrew Denny, III. Bernhard Eduard Fernow. frontisp., [i-v], 623 pp. Princeton University Press, 1951. cf. pp. 343, 463, 593.

Joya]. At 11000 feet Gadow met a herdsman who guided them up through the pine forests toward the summit.

After a few days on the mountain, amid plentiful rains, the Gadows descended and spent a part of a day in an excursion to the marshes around the Laguna de Zapotlán before taking the train again.

The plant-specimens collected by Dr. and Mrs. Gadow during their travels in Mexico, in this and other years, were presented by Mrs. Gadow to the British Museum (Natural History) in 1929, after her husband's death. There were about 200 in all, mostly not critically determined. No list of determinations was made, and it is not possible to say how many were collected in Jalisco. At least one from the Nevado de Colima, *Penstemon atropurpureus,* has been cited in the literature (Kew Bull. 1938: 7. 1938). Gadow himself wrote a charming popular account of his trip to the Nevado; this is Chapter XXIV of "Through Southern Mexico" (pp. xvi, 527. illus. Witherby & Co., London, 1908). The above description of his trip is taken from the book, which contains numerous references to plants and remarkably good descriptions of the plant-associations and zones of the Nevado. For a brief biographical note on Gadow, see Herpetologia 5 (Suppl. 1): 19. 1949.

Gaiser, Lulu Odell (1896–1965). As a Research Fellow of the Biological Laboratories, Harvard University, Dr. Gaiser travelled in Mexico and Guatemala from September to December, 1950, studying certain genera of Compositae. She collected herbarium specimens and material for cytological study from various localities. She visited Guadalajara and Río Blanco during the last week in October, and her nos. 57–73, representing the genera *Brickellia, Barroetea, Carminatia, Ageratella* and *Eupatorium,* were obtained at this time.

The following notes on her itineraries were supplied by Dr. Gaiser at my request: By taxi, along the highway west of Guadalajara toward Ameca, near km. 38, in a little arroyo near Las Tortugas River, October 26 (nos. 57, 58); near km. 48, along the railroad west of Orendain, October 16, (60, 61); 16 km west of Guadalajara, roadside, October 26 (62); by taxi to the end of the road at the Old Baths in the *barranca* east of Guadalajara, thence by foot to the top, October 27 (63–66); by taxi to the village of San Sesinto, thence on foot past Hacienda Magdalena toward Río Blanco, October 28 (67, 68); continuing by taxi to Río Blanco, thence on foot toward Sierra San Estéban, October 28 (69–71); returning by taxi via Zapopan, on a grassy slope about 13 km from Guadalajara, October 28 (72, 73).

The principal set of Dr. Gaiser's collections is in the Gray Herbarium (GH) and duplicates have been distributed as noted in her paper on *Brickellia.*[1] Some of her own collections, and also some that were made at her request by M. S. del Castillo, are cited in this paper and in her other published works on the Kuhniinae.[2]

Galeotti, Henri-Guillaume (1814–1858). A Belgian-French geologist, botanist, and horticulturist, Galeotti first visited Nueva Galicia in the last weeks of 1836. His travels are less well documented than those of almost any of the major collectors of this period, but to a degree they can be reconstructed from one published account, that of Lesègue,[3] and from incidental references in papers published by Galeotti himself. Some information may be obtained from the citations of localities and dates of flowering in

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[1]Chromosome studies in Kuhniinae (Eupatorieae). I. Brickellia. Rhodora 55: 253–267. 1953.

[2]Some rarely collected Mexican Brickellias. Rhodora 54: 229–232. 1952; Studies in the Kuhniinae (Eupatorieae) II. Journ. Arnold Arb. 35: 87–133. 1954.

[3]Lesègue, Antoine. Musée botanique de M. Benjamin Delessert. pp. [x], 588. Paris, 1845. The account of Galeotti is on pp. 209–211. Lesègue seems to have obtained his information directly from Galeotti, but the data as published are sometimes conflicting. All other contemporary accounts of Galeotti's work in Mexico seem to have been copied from Lesègue. I have not been able to locate any letters, fieldbooks or other notes, or any first-hand information about Galeotti. Even his herbarium specimens are deficient because many of them do not bear the year of collection.

the *Enumeratio*[1] and in the memoir on ferns[1] published by Martens and Galeotti. For example, Lasègue says Galeotti went to Real del Monte, Hidalgo, in July 1836, and botanized there for two or three months. This is corroborated by the statements in the papers by Martens and Galeotti, where about 175 species are cited from near Real del Monte, and the dates are almost all from August to October.

After his sojourn at Real del Monte, Galeotti left for the Pacific Coast. Lasègue says he left at the "end of 1835" [i.e. 1836], and travelled to San Juan del Río, Celaya, Salamanca, León, Guadalajara, and San Blas, after which he returned to México, visiting Guanajuato and Santa Rosa on the way. Perhaps Galeotti's account of the geology of Guanajuato was prepared during this trip; it was sent to Brussels in August, 1837, and published the next year (Bull. Acad. Brux. 5: 196–202. 1838). Presumably his paper on the geology of Lake Chapala (op. cit. 6: 14–29. 1839) was prepared at this time also. We suppose from a date in this paper that he was at Lake Chapala on February 27–28, 1837.

On a second trip to western Mexico, Galeotti left for Michoacán in July 1837 (Lasègue); he was in Morelia on August 9, and left for Jorullo about August 24. Judging from the citations in the *Enumeratio,* he went from Morelia to Pátzcuaro, Ario, and Jorullo, then returned to Ario (where he was on September 1 and 4), and continued by way of Taretan, Michoacán, past the foot of Tancítaro to Los Reyes and on to Guadalajara (where he was on November 22) (cf. Bull. Acad. Brux. 5: 150. 1838; op. cit. 8: 438. 1841). Perhaps it was at this time, before his arrival in Guadalajara, that he visited the Volcán de Colima.[2] Lasègue says he left for Aguascalientes and San Luis Potosí in December, 1837, and returned to México in April, 1838.

Galeotti's richest collecting grounds were in Oaxaca and Veracruz; only about 35 species of vascular plants were reported by Martens and Galeotti from Nueva Galicia. Of these, two were from San Blas and most of the rest from near Guadalajara. About half of the latter are cited as from the Great Barranca of the "Rio Grande de Lerma," and from elevations varying from 2500 to 3000 feet. The remainder are cited simply as from near the city, or from the "plains" of Guadalajara, or in a few instances from Chapala. I do not know the year of collection of the specimens from near Guadalajara, but in the *Enumeratio* the months are always given as December, January, or February for the species from Guadalajara, from Chapala, and from the localities (Ixtlán, Tepic, San Blas) west of Guadalajara. Judging from the little we know about the dates of his two trips, it seems likely that most of the plants were collected during the earlier one, in 1836–1837.

Several new taxa were based by Martens and Galeotti on the latter's collections from Nueva Galicia, including *Antigonon cinerascens, Buddleja pseudoverticillata, Erythraea tenuifolia, Evolvulus pilosissimus, Quamoclit coccinea* var. *hirsuta,* and *Quamoclit pedata.* Among the ferns, new taxa were *Cheilanthes candida, Adiantum fragile* var. *pubescens,* and *Polypodium incanum* var. *fimbriatum.*

Galeotti's specimens have been widely distributed in the United States and in Europe. The first set (but by no means a complete one) is at Brussels, at the Jardin

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[1]Enumeratio synoptica plantarum phanerogamicarum ab Henrico Galeotti in regionibus mexicanis collectarum; auctoribus M. Martens et H. Galeotti [title varies slightly]. Bull. Acad. Brux. 9, pt. 1: 529–544. 1842; op. cit. 9, pt. 2: 32–47, 227–249, 372–393. 1842; op. cit. 10, pt. 1: 110–134, 208–224, 341–360. 1843; op. cit. 10, pt. 2: 31–52, 178–200, 302–321. 1843; op. cit. 11, pt. 1: 121–137, 227–243, 355–376. 1844; op. cit. 11, pt. 2: 61–79, 185–196, 319–340. 1844; op. cit. 12, pt. 1: 129–149. 1845; op. cit. 12, pt. 2: 15–36, 257–278. 1845.

Mémoire sur les Fougères du Mexique, et considérations sur la géographie botanique de cette contrée, par MM. M. Martens et H. Galeotti. Mém. Acad. Brux. 15: 1–99. *pl. 1–23.* 1842.

[2]cf. Biol. Centr. Am. Bot. 2: 213. 1881, and 3: 690. 1886. Hemsley cites here two collections from an elevation of 4000 feet, one from "Colima," the other from "Volcan de Colima." Probably these are from the same locality.

Botanique National (BR). According to a report prepared by A. Cogniaux in 1875, there are at least 7297 numbered collections, of which no more than 4620 could be found at Brussels. The best duplicate sets, according to Cogniaux, were at Kew (K), Paris (P), and Vienna (W).

Gentry, Howard Scott. As a plant explorer for the United States Department of Agriculture, Gentry worked in Mexico from late February until the end of the year 1951, studying *Dioscorea, Agave, Yucca,* and other possible sources of cortisone. For a part of the time he was associated with Eugene C. Ogden and Charles L. Gilly. Their collections were principally of materials for propagation and for chemical analysis, but herbarium specimens were taken also, mainly as vouchers for the other mateirals. Collections were numbered in one continuous series including not only herbarium specimens but also living plants and materials for analysis.

Gentry made a few collections in Jalisco in May (Tierra Blanca, May 17, nos. 10464–10468; Tequila, and Plan de Barranca, May 19, nos. 10469–10478). He then proceeded to Tepic, where Gilly joined him on May 21. After several days of collecting near Tepic, Gentry and Gilly made a trip by automobile through southern Sinaloa to the highlands of Durango, returning to Tepic on June 17. They collected in Nayarit until July 15, when they returned to Guadalajara, and Gilly continued to Mexico City, which he reached July 23. Gentry continued by automobile to Autlán and to Tecomate, 32 miles southwest of that place; he then returned to Tepic by way of Guadalajara. The herbarium specimens taken by Gentry, and those collected jointly by Gentry and Gilly, were deposited in the Herbarium of the U.S. National Arboretum (USNA). The following general summary has been provided by Dr. Gentry: Gentry and Gilly collected on several occasions, between June 22 and July 15, along the road to Jalisco, Compostela, Mazatán, and Las Varas (Herbarium specimens representing 100 numbers); similar short excursions were made along the road to Jalcocotán during the same period and also during their first visit in May (herbarium specimens representing 60 numbers). Joint collections in all categories were as follows: Nayarit, May 22–26 (nos. 10478–10513); Nayarit, June 22–July 15 (10644–10877); Jalisco, July 16–17 (10878–10914).

Collections made by Gentry alone, after Gilly's departure, were as follows: Between Cocula and Autlán, July 21–22 (nos. 10915–10941, including 17 numbers representing herbarium specimens); mountains southwest of Autlán, and lowlands as far west as Tecomate, July 23–26 (nos. 10942–11010, including 48 numbers representing herbarium specimens); Arroyo del Obispo, Nayarit, August 2 (nos. 11025–11031); Santa María del Oro, Nayarit, August 2 (nos. 11012–11024).

On Gentry's return to Tepic he collected nos. 11037–11044, August 3, in the course of a last trip along the road to Compostela and Las Varas. He concluded his work in the Jalisco-Nayarit area with 13 additional collections in the vicinity of Tepic; the last number was 11052, taken on August 8.

Ghiesbreght, Auguste Boniface (1810–1893). A Belgian botanist who lived many years in Mexico, Ghiesbreght is identified chiefly with the states of Chiapas and Tabasco. The best-known biographical sketch is that by Rovirosa.[1] There are a few records of specimens collected by Ghiesbreght at Colima, but I cannot substantiate these, and know nothing of the circumstances under which the collections may have been made. See, for example, the report of *Aristolochia pardina* (DC. Prodr. 15, pt. 1: 450. 1865), and that of *Cosmos sulphureus* (Field Mus. Publ. Bot. 8: 409. 1932).

The herbarium in Paris (P) contains many specimens collected by Ghiesbreght; most of them I have seen bear a printed label, with heading "HERB. MUS. PARIS.,"

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[1]Rovirosa, José N. Vida y trabajos del naturalista belga Augusto B. Ghiesbreght, explorador de México. Naturaleza II, 1: 211–217. 1891.

and a line at bottom "Mexique-Province d'Oaxaca M. Ghiesbreght. 1842." In this case 1842 is almost certainly the date of receipt in Paris, not the date of collection; the practice of recording accessions in this way was common in Paris at this period. It is probable that this general printed label was distributed with the sets of Ghiesbreght's duplicates, without any attempt to add the real field data to the specimens. The specimens at Paris, however, commonly bear additional handwritten labels, often with precise information as to locality of collection. A sheet of *Viguiera morelensis,* for example, bears the "Oaxaca" label, with the hand-written locality "près de Cuernavaca." A specimen of *Verbesina virgata* from "Oaxaca" is labelled "forêts de pins sur le versant du Volcan de Toluca vers Cuernavaca." The extent of Ghiesbreght's travels into western Mexico is unknown to me but I have seen one specimen (*Bolanosa coulteri*) from Apatzingán, and there seems no reason to doubt that he collected near Colima also.

Gilly, Charles Louis (1911–1970). With W. J. Bonisteel and Donald Dodds, Gilly collected in the State of Colima in March, 1943. Approximately 75 gatherings were distributed under the joint names of the three collectors. The principal collector was Gilly, but the serial numbers (1–75) are those of the joint collectors. Gilly began an independently numbered series of collections the same year, and began joint series with other collectors at about the same time, so that for precise identification of any given collection made by Gilly and his associates, one must cite the serial number and the names of all the collectors. Gilly's herbarium was purchased by the University of Michigan (MICH) in 1956. Most of the collections from the State of Colima were obtained near the city of the same name; a few came from the vicinity of Manzanillo. For additional collections made by Gilly, see under Gentry.

Goldman, Edward Alphonso (1873–1946). See Nelson.

Goldsmith, Peter Hair (1865–1926). Goldsmith, the minister of the First Unitarian Church in Salem, Massachusetts, undertook a trip to Mexico in the summer of 1905, primarily because of an interest in ethnology. He was aided by the Peabody Museum of Salem. As an incidental activity he took up botanical collecting. A collecting outfit was furnished for him by the Gray Herbarium, and he was authorized to collect plants at eight cents a specimen, "to include not more than five specimens of any one plant," the whole order not to exceed the sum of $100.00 (Robinson, letter of March 22, 1905). He was in Salem until at least June 20, 1905, when he went directly to Colima; his first collections were made at Hacienda San Marcos about July 12. He obtained a total of 171 numbered collections, or 827 specimens in 1–14 sets (Gray Herb. Misc. Plant lists 7: 152–155). He ascended the Nevado de Colima to above timber line, then sometime about the middle of August went to Nayarit, where he collected in the foothills and in the valley of the Río Jesús María until early September. A summary of his botanical collections, as far as known, follows:

Hacienda San Marcos and vicinity, July 12–17 (nos. ?1–33); east side of the Volcán de Colima, July 20–24 (8000–14000 feet; numerous collections are from Cuchilla, 10000–10500 feet) (?34–85); Colima, July 28 (86); Hacienda San Bartolo, Tecomán, Colima, August 1 (94–99); Zapotlán, Jal., August 7–8 (91, 111–125); near Tepic, August 22 (126); near Pochotitlán, cañón of Santiago River, 4000 feet, [Nayarit], August 23 (128); Coyultitas, Sierra Madre, "Tepic," 4000 feet, August 24 (131); El Maguey, Sierra Madre, "Tepic," 2500 feet, August 26 (132); Cañón of Jesús María, "Tepic" (or Río Jesús María), 1000 feet, August 29–September 4 (133–165); Juana Burra, "Tepic," 2000–4000 feet, September 5 (166–167); Cuesta de San Luisito, "Tepic," 4500 feet, September 7 (168); Zapotlán (169); Los Bules, Cañón de Jesús María, 1400 feet, September 4 (170).

Goldsmith's field-records, if any exist, have not been located, but evidently his numbers beginning with 128 were collected in the course of the trip described below. He went to Tepic primarily to carry out an expedition to the country of the Cora and

Huichol Indians. This he accomplished successfully; I was informed by Dr. Ernest S. Dodge, then Director of the Peabody Museum, that their ethnological collections catalogued as numbers E8250 through E8445 were obtained by Dr. Goldsmith on this trip. He left Tepic apparently about August 22, and travelled northeasterly through Pochotitán, thence down and across the Río Santiago, northeast to Coyoltita, and north to Guaynamota near the mouth of the Río Jesús María. He ascended this river to the settlement of Jesús María, passing Los Bules en route. He collected at several localities, probably all small Indian settlements in this area, viz. El Maguey, San Luisito, Santa Bárbara, Santa Rosa, Santa Clara, and La Mesa. The date of his return to Tepic is unknown to me.

Gómez, José Pérez. Guarda Forestal in Pihuamo. Collected pines in May 1938 or 1939 for Professor Martínez; his collections from Pihuamo, from Cerro del Halo and from Tequila are cited by Martínez. His name is abbreviated by Martínez as J. P. Gómez.

Gómez y Gutiérrez, Augustín. Longtime resident of Guadalajara, and author of the *Flora silvestre del valle de Guadalajara* (for which see the introduction to this paper). I am especially indebted to Ing. Gómez y Gutiérrez for his help and guidance during the field-season of 1952. See McVaugh (1952).

Graber, Richard R., and **Jean Weber Graber.** In the course of an ornithological trip in western Mexico in December, 1955, Dr. and Mrs. Graber collected approximately 30 plant specimens, mostly in southern Nayarit. A set was presented to the University of Michigan (MICH) by Dr. B. L. Turner of the University of Texas (TEX), where the original set is preserved. Collections were made 2 miles east of Mazatán (11 miles west of Compostela), December 25; 20 miles west of Compostela, December 25–27; and 2.5–3 miles east of Las Varas, December 27–29.

Graham, Shirley Ann (Tousch). Mrs. Graham travelled in Nueva Galicia in 1961 and 1962, primarily to collect material for a revision of the genus *Cuphea.* The first set of her collections is at the University of Michigan (MICH).

Graham, William Lyle. See McVaugh (1970). Graham also travelled to Nueva Galicia in July, 1971, primarily to collect material for a revision of the genus *Dorstenia.* The first set of his collections is at the University of Michigan (MICH).

Gregg, Josiah (1806–1850). The author of the classic *Commerce of the Prairies,* Santa Fe trader, medical doctor, and amateur of botany, Gregg corresponded with his friend George Engelmann and sent to Engelmann many plant-specimens collected during his travels in Mexico, 1847–1849. Gregg served in a quasi-official capacity during the war between Mexico and the United States, practised medicine in Saltillo for a time, then finally decided to cross Mexico to the Pacific and travel thence to California. The "Diary and Letters of Josiah Gregg," edited by Maurice Garland Fulton (University of Oklahoma Press, 2 volumes, 1941, 1944), give a full and interesting account of the last decade of Gregg's life. The following summary is taken from volume 2, pp. 299–321.

Gregg's party, consisting of himself and six other foreigners and a Mexican servant, left Mexico City on April 26, 1849. They reached Morelia, Michoacán, on May 3, and left on the 7th. Following a route nearly parallel to, but often somewhat north of, the modern highway, they reached Zamora and Ixtlán on the 13th of May. The following day Gregg visited the boiling springs near Ixtlán, and the party continued to La Barca, where they crossed the Río Lerma on a ferry. On the 15th they crossed the river again near Ocotlán, and Gregg saw the Lake of Chapala from a convenient hill. The road led along the river as far as Atequiza, and thence to Guadalajara, which was reached on May 17.

After a week in Guadalajara—with a delay occasioned by the death and burial of one of the party—travel was resumed on May 23. The route was almost that of the present highway to Tepic: Zapopan, Venta del Astillero, Rancho del Arenal (May 23); Amatitlán, Tequila, Magdalena (May 24); Quemada, Venta de Mochitiltic, Barrancas (May 25); Ixtlán, Mizpa [Mexpan], Aguacatlán (May 26); a "malpais" [i.e. the recent lava-flows south of the volcano of Ceboruco], Tititlán [Tetitlán], Santa Isabel, Ocotillo (May 27); San Leonel, Tepic (May 28).

Gregg's account shows a lively interest in the people and scenery along the route. He discussed briefly the manufacture of the famous *mezcal* of Tequila, and described at some length the impressive gorge at Las Barrancas.

From Tepic the route led Gregg's party rapidly into the lowlands on May 31, by way of Hacienda de Ingenio (the notes say "310° 18 or 20 miles to Hac. de Ingenio"). On June 1 they forded the Río Grande at Santiago, and made their way into the lowlands toward Mazatlán.

Gregg's botanical specimens are numerous and well-documented, and many of those from northern Mexico have been studied and cited in taxonomic papers. His collections from southern and western Mexico, however, have received less attention and for the most part have not been critically studied. The principal set of his plants, comprising nos. 1–918 (collected in 1847), and a second series, nos. 1–1250 (collected mostly in 1848 and 1849), formed a part of the Engelmann herbarium, now incorporated into that of the Missouri Botanical Garden (MO). No list of the collections was ever published, but Engelmann kept a summarized account of the numbers, dates and localities and, for part of the collection of 1848–49 (nos. 668–1250), a copy of Gregg's original field-notes. The collections made in Nueva Galicia include approximately nos. 829 to 1100, so that field-notes are available for all his specimens from this area. These are in some cases quite detailed, and include not only descriptions and local names but also mention of medicinal and economic value. Unfortunately the botanical names of the species are not given, so that individual specimens cannot be located in the herbarium without some difficulty. I am indebted to the late Dr. Robert E. Woodson for permission to use the following abstracts from the manuscript materials in his care. The collections below are summarized by dates:

May 13, 1849. Near Zamora, Michoacán (nos. 825–838). Ixtlán, Mich. (844).
May 14. Near La Barca, Jalisco (839–841).
May 15. Between La Barca and Ocotlán, Jal. (842); west of Ocotlán near Río Grande (843).
May 16. Near Atequiza, Jal. (845–851).
May 17. Between San Antonio and Guadalajara, Jal. (852–853); dry plains east of Guadalajara (854–856).
May 21. Campo Santo, Guadalajara (858).
May 23. West of Guadalajara (857, 859–862).
May 24. Near Amatitán [Amatitlán], Jal. (863–867); near Tequila, Jal. (868–873); west of Magdalena, Jal. (874).
May 25. West of Magdalena (875–883); east of Barrancas, Jal. (884–885, 889–890); Mochitilte, Jal. (886–888); Barrancas (891–897, 1250).
May 26. Barrancas (898–913); near La Cirata, [Nayarit?] (914); Ixtlán, Nay. (915–916); near Mezpa [Mexpan], Nay. (917–924); Aguacatlán, Nay. (925–927, 941); west of Aguacatlán (942–947); Malpais ("heaps of volcanic rocks") (948).
May 27. West of Aguacatlán, Nay. (928–940, 994–995); Tetitlán, Nay. (949–952).
May 28. Ocotillo, Nay. (953–962); mountains east of San Leonel, Nay. (963–979); west of San Leonel (980–984).
May 29. Tepic, Nay. (985–988); mountain near Tepic (989–993, 1246).
May 30. Tepic (996–997).
May 31. West of Tepic (998–1014).
June 1. West of Ingenio, Nay. (1015–1025, 1034–1041); Ingenio (1026); valley of Río Grande east of Santiago, Nay. (1027–1033, 1042–1043, 1047–1069); highlands east of Santiago (1044–1046).
June 2. Near Santiago (1070–1074); north of Santiago, to San Pedro, Nay. (1075–1090).

Gregory, David P., and **George Eiten**. These collectors obtained 260 numbers in Jalisco and Colima in June and July, 1956, traveling principally by automobile in the area south of Guadalajara. A set of the specimens was presented by the collectors to the University of Michigan (MICH), and other sets have been distributed to the Missouri Botanical Garden (MO), the Instituto de Biología (MEXU), and elsewhere. The first collections (nos. 72–117) were made June 17–18 in the pine forests southwest of Mazamitla. Following a return to Guadalajara, collections were made June 20–23 as follows: *barrancas* northeast of the city (118–144); Garden of Clemen Court, west of the city (145); Cerro del Colli (146–153); *barrancas* (154–180). Some plants were taken here near the electric power station at the summit, along the burro trail to the river, and on the north side of the river downstream from the Puente de Arcediano. On June 25–28 the collectors worked on Cerro Viejo, along the trail leading up from Zapotitán; they obtained nos. 181–186 (June 25) and 201–204 (June 27) in cultivated fields on the lower slopes (elevations of 1730–1840 m.). On June 26 they ascended from the village, taking nos. 187–200 in or near a shallow wooded ravine through which the trail passes, at elevations of 1840–1880 m. On June 27 they collected nos. 205–235 at elevations between 1830–2200 m., and nos. 237–256 from the upper slopes, 2300–2800 m. No. 236 was obtained from a barnyard in Zapotitán.

On June 30 no. 257 was collected on the roadside between Zacoalco and Sayula, and on July 1–2 nos. 258–308 in the course of an ascent of the north side of the Nevado de Colima to a point a few hundred meters from the summit. Nos. 258–276 (July 1) came from the pine forests of the northeast side, at elevations of 2700–2800 m. On July 2 the collectors ascended by auto to a point where the road became impassable (2360 m.), and continued on foot to the end of the lumber road, and beyond it on cow trails to the summit of the ridge (3330 m.); Gregory descended to a trailside hut (probably La Joya) and thence ascended the slope to the peak, where he obtained nos. 297–306. Nos. 277–296 and 307–308 came from the forests at elevations from 2360–3300 m.

Later collections were nos. 309–334, taken along the shore in the vicinity of Manzanillo, July 11–12, and nos. 335–336, taken at Ciudad Guzmán on July 16.

See also Straw.

Griffiths, David (1867–1935). Griffiths, of the United States Department of Agriculture, specialist in the genus *Opuntia* and in certain groups of grasses, visited Jalisco on at least two occasions, and made collections which are for the most part in the United States National Herbarium. The type of *Opuntia fuliginosa, Griffiths 7715,* was collected in April 1905 at Guadalajara, and is in the herbarium of the Missouri Botanical Garden.[1] The author notes[1] that "the original description was drawn at Estansuela in western Jalisco, from plants in bloom. This was subsequently compared with plants at Guadalajara, and still further amended by a second visit to the latter place during maturity of the fruit."

Griffiths was in Jalisco again in 1909. He collected specimens of *Agave* at Tequila and at least two species of *Bouteloua* at El Llano,[2] the latter September 16–19.

Guzmán H., G. See Muller.

Harshberger, John William (1869–1929). Harshberger, a professor at the University of Pennsylvania, made a trip to Mexico in 1896.[3] He botanized near Mexico City and in Veracruz, August 12–31. On September 1, "Left the City of Mexico alone en route for Guadalajara via Irapuato, where a number of days (September 2d to

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[1]Rep. Missouri Bot. Gard. 19: 262. 1908.

[2]Contr. U.S. Nat. Herb. 23: 116, 117. 1920; op. cit. 14: 426, 427. 1912.

[3]Harshberger, John W. Botanical observations on the Mexican flora, especially on the flora of the Valley of Mexico. Proc. Acad. Philadelphia 1898: 372–413. 1898.

September 5th) were spent. The celebrated barranca was visited in company with an Indian, and a number of plants collected." Harshberger's herbarium was given to the University of Pennsylvania (PENN).

Hartweg, Karl Theodor (1812–1871). A native of Germany and a gardener in the employ of the Horticultural Society of London, Hartweg was sent by that society to Mexico to collect ornamental plants suitable for British gardens. He was at the same time allowed, under certain restrictions, to furnish on his own account sets of dried specimens for those who should subscribe to them through the Society. He made large collections of herbarium specimens, which have been widely distributed in Europe and the United States. The collection as a whole was enumerated and the novelties described by Bentham,[1] and the principal set of specimens is in the Benthamian herbarium at Kew (K). The following account has been adapted from that in the introduction to the 1970 reprint of *Plantae Hartwegianae.* Much of what is known about the details of Hartweg's travels in Mexico has been derived from his own published notes (Trans. Hort. Soc. London II. 3: 115–162. 1844–1845; Jour. Hort. Soc. London 1: 180–185, 2: 121–125, 187–191; 3: 217–228. 1846–1848), and from his letters and reports preserved in the Library of the Royal Horticultural Society.

After landing at Veracruz early in December 1836, Hartweg made his way by easy journeys to Zacuapán and Jalapa, which latter place he reached on December 28. He soon moved on by stagecoach to Mexico City and then to Guanajuato. He spent a week in Silao with an acquaintance, then made an excursion to a mountain called El Gigante, "the highest point of the range of mountains of Guanajuato"; this peak is about 15 kilometers north-northwest of the city of Guanajuato, and reaches an elevation of about 2936 m. By the 13th of April Hartweg was in León, where he seems to have established a temporary headquarters. On June 17 he was in Lagos, Jalisco, whence [he wrote]: "After a month's fruitless wandering, I left, on the 13th of July for Aguas Calientes." Here, he said, "I found a little more occupation." Probably unwittingly, Hartweg had come to the highlands of Guanajuato in the height of the dry season, which here as in much of western Mexico begins in October or November and ends in June or July. Although he found the area "parched and barren," he made a considerable collection in the vicinity of Guanajuato in the early spring, then (as indicated by the citations in *Plantae Hartwegianae*), he obtained approximately 70 collections from the vicinity of León and 22 from Lagos. In a stay of two months near Aguascalientes, where he must have encountered the summer rains, he obtained about 130 numbered collections of herbarium specimens.

In search of a more productive field of operations, Hartweg left Aguascalientes on September 22, to visit the mining center at Bolaños, Jalisco, which Coulter had visited in December, a decade earlier. Hartweg arrived on October 4, 1837, at a most favorable time of the year for botanical collections. His route thither from Aguascalientes I do not know; several established routes were open to him. He may have gone in the direction of Zacatecas as far as Rincón de Romos before turning westward toward Villanueva, whence a route turned southwestward toward Colotlán and Bolaños. Another likely route was open by way of San Juan de los Lagos, Mextiacán, Nochistlán, Juchipila and Tlaltenango. Bolaños in 1837 was relatively far more accessible than it is now, because travel by pack-train was the accepted method of freighting everywhere in the mountains, and pack-roads were kept open. One of the alternative roads from Zacatecas to Guadalajara in Hartweg's time came through Colotlán, Tlaltenango, San Juan del Teul [here approximately 40 kilometers east of Bolaños], and crossed the barranca at San Cristóbal, north of Guadalajara. With the

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[1]Bentham, George. Plantae Hartwegianae, pp. iv, 393. 1839–1857. Facsimile reprint (Hist. Nat. Class. LXXX) 1970, by J. Cramer, Lehre, with introduction (pp. 1–102) by Rogers McVaugh.

decline in importance of the mines at Bolaños, and the difficulty of maintaining automobile traffic across the *barranca* of the Río Grande, there is little intercourse today between Bolaños and the capital, Guadalajara. The only practical access is by way of Zacatecas, and even this way traffic is limited to trucks in the dry season and pack-animals in the wet. For an account of Mexican roads and itineraries in mid-nineteenth century, the reader is referred to the work by José J. Alvarez and Rafael Durán, "Itinerarios y Derroteros de la República Mexicana" (Mexico, 1856, pp. 480).

The settlement of Bolaños was in the arid river valley, and as Hartweg was primarily interested in plants of the higher elevations he at once took advantage of an opportunity to get into the mountains west of the river, where at about 8000 feet he found fine forests of oak, pine, and various Ericaceae, near "Berberea, the Mining Company's wood cutting establishment," which he reached, as he wrote, "after a four leagues' ride, and constant ascent." It was apparently on this same trip, in November or December, that Hartweg visited the Huichol Indians ["Indiens Guicholes"], as reported by Lasègue. Specimens of approximately 41 species, about half of which were new to science, were obtained by Hartweg in the vicinity of Bolaños. This seems a meagre collection in view of the fact that he was there at the height of the growing season. He left Bolaños on January 10, 1838, and reached Zacatecas 4 days later. After about six weeks near Zacatecas, he left on February 26 for San Luis Potosí, in which state he passed the remainder of the winter but where he collected little. On April 10, wishing to collect seeds of certain plants that had been immature at the time of his previous visits, he set out again for Zacatecas and Bolaños; from the latter place he made a quick trip to Guadalajara, then returned to Bolaños, Zacatecas, and Aguascalientes. At this point, according to Hemsley, "This region proving almost fruitless for his purposes, Hartweg went direct to Morelia, the capital of Michoacan. . . ." Hartweg himself wrote that, receiving "hardly any recompense" for his last trips, he proceeded to Morelia, where he arrived late in June.

On Hartweg's second visit to America he spent six months in Mexico on the way to his destination in California. He seems not to have collected any herbarium specimens in Mexico on this trip, but he sent back to England several boxes of living plants from Nayarit, where he spent the winter season of 1845–1846. He left Querétaro by stage on December 19, reached Guadalajara on the 25th, and Tepic on January 1, 1846. While waiting for his luggage to arrive from México, he spent about two months exploring the surrounding countryside, visiting Cerro San Juan (early in January), Volcán Ceboruco, via Ocotillo and Uzeta (ca. January 8–12), Compostela and the villages Amatanejo and Los Reyes (Jalisco) across the Río de Ameca (January 20–25), San Blas (February), and the Río Grande de Santiago (February). He left for San Blas and Mazatlán on March 14.

The living plants sent to Europe by Hartweg began to be described and figured in the botanical literature within a few months after he began to collect in Mexico in 1836. *Plantae Hartwegianae* deals only with herbarium specimens; Bentham did not attempt to describe and enumerate the novelties among the living material, but Lindley and various other authors did so. Neither the value nor the fate of the horticultural collections is easy to trace in detail, as the collections of seeds and other propagules were distributed upon arrival to the members of the Horticultural Society, and eventually became widely dispersed. Of the 5 or 6 boxes of seeds, pine cones, orchids, and other perennials that resulted from his work near Tepic in 1846, most reached England in good condition. During his first trip to Mexico he packed and sent to England 43 boxes of living plants, and although delays were sometimes unduly long, something was salvaged from almost every box.

Hay, Robert. See Rose (1901).

Hernández Xolocotzi, Efraim. Hernández, a member of the faculty of the Escuela Nacional de Agricultura, Chapingo, México, has collected on several different visits to Nueva Galicia. For the most part his specimens have been taken in connection with his work on agriculturally oriented projects, e.g. the cultivation of castor bean; the potential production of the native oil-palm, *Orbignya;* study of diseases of native grasses and legumes; selection of profitable strains of cultivated wheat, corn, and beans, etc. His first visit was from November, 1943 to January, 1944, when he collected nos. 1–73 in northern Nayarit, 113–120 near Manzanillo, Colima, and 121–146 near the coast between Miramar and San Blas. In May and June, 1946, he collected nos. X-1538–X-1586, mostly in northern Nayarit north of our area. In September of the same year he collected nos. X-2461–X-2774, chiefly along the highway between Ojuelos and Guadalajara, and near the latter city; most of the collections were of grasses or legumes. In May 1947 he collected seeds of cultivated plants, nos. X-3324–X-3356, visiting Juanacatlán, Sayula, Tapalpa, and Ciudad Guzmán. In September and October, 1948, he collected (mostly *Tripsacum* and other grasses), chiefly along the highway between Tepic and Tepatitlán, including nos. X-3717–X-3747 in the Barranca de Oblatos, X-3748–X-3757 in Nayarit, X-3758–X-3763 near Tequila, and X-3780–X-3792 east of Guadalajara. In December, 1949, he collected widely in Jalisco and Nayarit, taking almost all grasses (nos. X-4603–X-4701), chiefly from near the highway between San Juan de los Lagos and San Blas, from that between Guadalajara and Autlán, and from a locality between Los Volcanes and Talpa (nos. X-4673–X-4678).

In 1960 Professor Hernández accompanied the University of Michigan expedition from September 16 through October 1; see McVaugh (1960).

The principal sets of herbarium specimens collected by Hernández have been distributed as follows: Legumes to Gray Herbarium (GH); Grasses, to U.S. National Herbarium (US) and Gray Herbarium, and to the herbarium of the Escuela Nacional de Agricultura (ENA); general collections to the Instituto de Biología, México (MEXU). A set of the 1943–44 collections is at the Univeristy of Michigan (MICH).

Hill, Jane (Hassler). As a part of an ethnobotanical study, Mrs. Hill made a collection of about 60 numbers in the Municipio de Aquila, in January, 1962. Most of the specimens were from the valley of the Río de Ostula, and near the village of Ostula. The plants were distributed by the University of California, Los Angeles (UCLA); a partial set is at the University of Michigan (MICH).

Hinds, Richard Brinsley (–d. before 1861). The account of the botany of the voyage of H. M.S. Sulphur[1] was nominally edited by Hinds, who was described on the title-page as a Navy Surgeon "attached to the expedition." Hooker and Arnott (in the Botany of Captain Beechey's Voyage) imply that Sinclair (q.v.) was the surgeon actually on duty in the Sulphur.

The "botanical descriptions" in the "Bótany of the Sulphur" are attributed to George Bentham, and in fact the entire work is that of Bentham except for notes on itineraries contributed by Hinds to the early fascicles (pp. 1–5, 58–63). According to a statement on page 182, Hinds had no connection with the work except for the first four parts (pages 1–96).

Bentham states (Bot. Sulph. 182) that "The principal collection placed in his hands was that made by the Editor himself, Mr. Hinds, through whose liberality the original specimens have been deposited in the subscriber's herbarium. This extends over the whole of the stations mentioned in the work."

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[1]Botany of the voyage of H. M. S. Sulphur, under the command of Captain Sir Edward Belcher, . . . 1836–1842. Edited and superintended by Richard Brinsley Hinds, . . . The botanical descriptions by George Bentham, Esq. pp. 1–195, *pl. 1–60.* London, 1844–1846.

Some remarks concerning the collections of Sinclair are equally applicable to those of Hinds: The specimens, now at Kew, are mostly undated, without data except for mention of locality and collector. Apparently there is no mention of Hinds in Barclay's journal, and I have not learned anything about his collecting activities from other sources, so that little can be said about his Mexican collections other than the following:

If Hinds collected plants in Colima or Nayarit, it was presumably during one of the times when the Sulphur was in port. She stopped in Manzanillo Bay, according to Barclay's journal, from about May 17 to May 21, 1837; she lay at San Blas from May 28 to June 5, 1837, from December 20, 1837 to January 3, 1838, and again from December 4 to December 21, 1839.

Approximately 265 species were reported by Bentham from Mexico, including about 100 each from Acapulco and Tepic, 23 from "Manzanilla Bay," 12 from San Blas, 8 between San Blas and Tepic, 3 from "San Blas and Tepic," and 28 without locality except "Mexico." About 40 species from Mexico were proposed as new to science, including 15 from Nayarit and 6 from "Manzanilla Bay." Since the name of the collector is ordinarily not mentioned for individual species described in the "Botany of the Sulphur," it is impossible to state how much Hinds had to do personally with the collections. It is not clear, for example, whether Hinds, Barclay or Sinclair was primarily responsible for the relatively large amount of material collected at Tepic, since apparently all three men made the trip there from San Blas. For individual collections the name of the collector can usually be ascertained by reference to the herbarium at Kew.

Hinton, George Boole (1883–1943). An English mining engineer, Hinton lived many years in Mexico and made large collections, especially in the States of México, Michoacán and Guerrero, from the year 1932 forward. His activities were noted, and his collections were cited and described, in various publications but especially in the Kew Bulletin, from 1934 (Kew Bull. 1933: App. 32. 1934) to 1939, and in some later articles. The first set of his collections is at Kew (K), and comprises some 14,500 numbers (Kew Bull. 13: 155. 1958). After his death the collecting was continued by his son James Hinton, to whom I am indebted for much of the specific information that follows. Eventually about 18,000 numbers were included in the Hinton herbarium. Many duplicates have been distributed, both in America and in Europe, and several hundred new species have been based on his collections, most of which came from localities not readily accessible to plant-collectors.

In his later years plant-collecting became a full-time occupation for Hinton, and he was assisted from June, 1937, to June, 1941, by his son James. All the specimens were serially numbered in order of collection, and distributed with a label headed "Herbarium of George B. Hinton," the collector's name usually given merely as "H. et al." On some occasions two parties collected in different areas during the same field-season, at which time blocks of different collection-numbers were assigned to each party. In 1938, for example, James Hinton collected in eastern Michoacán, mostly in the vicinity of Zitácuaro and as far south as Huetamo, from June to November. The collections were assigned nos. 11800–11999, and 13000–13570. During the same season, from August 1938 to the end of the year, and through the year 1939, George B. Hinton collected in western Michoacán at the edge of Nueva Galicia, using the series 12000–12999, 13600–13999, and 15000–15392. During the autumn season of 1940, from October to December, James Hinton collected on Cerro Tancítaro (nos. 15435–15735). From March 1941 to January 1942, George B. Hinton collected mostly in the mountains and lowlands between Coalcomán and the Pacific Coast (nos. 15742–16063, 16082–16313). The total number of collections from western Michoacán seems to have been slightly more than 2000.

Following is a generalized resumé of the work of the Hintons in western Michoacán in 1938–39. The data are derived from herbarium specimens, and in part from a nearly complete set of labels maintained by Mr. James Hinton:

Apatzingán and Acahuato (nos. 12000–12071, August 12–17, 1938); Buenavista Tomatlán and Tepalcatepec (12072–12118, August 22–27); vicinity of Coalcomán and Villa Victoria (12127–12531, September 5–November 8); trip to Villa Victoria, Sierra Naranjillo, Huizontla, and Aquila (12532–12687, November 10–26); vicinity of Coalcomán (Puerto Zarzamora, Sierra Torrecillas, etc.) (12688–12999, November 27–February 24, 1939); vicinity of Coalcomán (13600–13728, March 6–April 28); trip to Villa Victoria, Sierra Naranjillo, Chacalapa (?13729–13799, May 5–June 15); vicinity of Coalcomán (13800–13999, June 16–July 25); vicinity of Coalcomán (15000[1]–15144, July 25–September 2); trip to Aguililla and Ortigal (15145–?15254, ?15286–15337, September 11–October ?1, October ?6–16); Sierra Torrecillas (15255–15285, October 4–5); El Barroloso (15339–15386, October 20–26); Aguililla, El Purucho, etc. (15387–15390, October 26–November 14).

In October and November, 1940, James Hinton collected on Cerro Tancítaro, from a base at the village of Tancítaro at about 2300 m elevation. He worked in all directions from the village, climbing many times to the summit of the mountain, and collecting nos. 15435–15735, mostly at elevations of 2000 m and above.

In 1941, collecting began March 1, near Coalcomán, and continued to January 16, 1942. A few collections were taken in Aguililla and Apatzingán, but most of the specimens were from the lowlands (Huizontla, Coahuayana, Aquila, Ostula, Coire, Pómaro, Cachán, Tizupan). The numbers ran from 15742–16313, except that a series from about 16064–16081 were taken in Temascaltepec (Estado de México).

As remarked by Brand (1960, p. 231), some of the Hintons' localities are not easy to locate on ordinary maps. It was their practice to note on the label of each specimen not only the precise locality of collection, but also the name of the "Distrito," a political subdivision no longer used in Mexico. In western Michoacán most of the Hinton collections came from the District of Coalcomán (including localities in the modern *municipios* of Coalcomán, Chinicuila, Coahuayana and Aquila) or from the District of Apatzingán (including localities in the *municipios* of Tancítaro, Apatzingán, Buenavista, Tepalcatepec, and Aguililla). The mountain mass of Cerro Tancítaro, now included in the municipality of Tancítaro, was formerly a part of the District of Uruapan. Abbreviated references to "Coalcomán" alone, to "Uruapan," or to "Apatzingán," in literature citing the Hinton collections, should be accepted with caution.

Hitchcock, Albert Spear (1865–1935). The Agrostologist of the United States Department of Agriculture, Hitchcock made a trip to Mexico in the summer of 1910 to investigate forage conditions and collect specimens of the grasses. He later published technical and popular reports on his work.[2] He travelled principally by rail, with excursions to points of interest. In Jalisco and Colima he collected in September, at about fifteen localities along the railroad between Guadalajara and Manzanillo, with excursions into the Barranca de Oblatos and to the summit of the Nevado de Colima (this from Zapotlán). The published summary of his "places visited, and the numbers of the specimens collected" (Scient. Monthly 8: 138) does not agree in details with the information published in his "Mexican grasses." The following summary is taken from the data in the latter work:

La Junta, Jal. (nos. 6996–7001); Valencia, Jal. (7003–7005); Jala, Col. (7007–7014); Caleras, Col. (7015–7020); Armería, Col. (7021–7025); Manzanillo, Col. (7026–7046); Armería (7047); Tecomán, Col. (7048); Manzanillo (7049); Jala (7050); Colima, Col. (7051½); Coquimatlán, Col. (7052–7053); Alzada, Col. (7054–7110); Zapotlán, Jal. (7111–7147); Nevado de Colima and along trail from Zapotlán (7148–7168); Zapotlán (7169–7180); San Nicolás, Jal. (7181–7235);

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[1]Nos. 14000–14999 were collected in Guerrero by James Hinton.

[2]Mexican grasses in the U.S. National Herbarium. Contr. U.S. Nat. Herb. 17: 181–389. 1913; A botanical trip to Mexico. I. Scient. Monthly 8: 129–145; II. op. cit. 8:216–238. 1919.

Zapotlán (7237–7259); Guadalajara and near San Pedro (7260–7320); Barranca de Oblatos (7321–7370); Orozco, Jal. (7371–7386). On October 2, after finishing his work in Jalisco, Hitchcock collected nos. 7439–7494 near the City of Aguascalientes.

The grasses collected by Hitchcock are in the National Herbarium (US), and some duplicates have been distributed. Almost all the numbers are cited in his "Mexican grasses."

Hitchcock, C. Leo. Professor Hitchcock, of the University of Washington, led a group of 30 students on a field-trip by automobile, to Mexico during the summer of 1940. They were in Mexico a month (June 29 to July 28). Collections in our area were made as follows, all on one trip from Mexico City to Guadalajara: Mountainside above the east end of Lake Chapala, (Michoacán), 14 July (nos. 7157–7162); sandy shore at the west end of Lake Chapala, Jalisco, 14 July (7163–7170); hills south of Lake Chapala, Jalisco or Michoacán, 16 July (7171–7174). The specimens were distributed under the joint names of Hitchcock and L. R. Stanford. Additional collections were made in Michoacán, east of our area, July 13–17 (nos. 7133–7155, 7175–7180, 7204–7216). Duplicates were distributed from the University of Washington (WTU).

Holway, Edward Willet Dorland (1853–1923). Holway travelled extensively in Mexico and in Central and South America, primarily to study the fungi (*Uredinae*) that were his special interest. He collected numerous flowering plants, however, partly in connection with the identification of fungi, and partly because of his interest in the vascular flora. The vascular plants he collected in Mexico were sent for identification to J. N. Rose or to B. L. Robinson, and accordingly may be found at present either in the U.S. National Herbarium (US) or in the Gray Herbarium (GH). Holway's own herbarium, with his library and correspondence, is maintained separately at the University of Minnesota (MIN).[1]

Gray Herbarium records (Misc. Plant Lists, volume 6, pp. 304–307, 329, 358–360) show that they received from Holway 66 specimens from Mexico collected in 1898 (numbered from 3000 to 3235), 106 specimens collected in 1899 (nos. A, X, 3169, 3411–3767, not inclusive), and 10 specimens of *Mimosa* collected in 1903 (nos. 5086, 5213–5368, not inclusive, and A). Probably by no means all of these are from Jalisco, although Holway is reported to have visited that state in all of the years in question. In 1899 he spent several days (at least September 18–23) in the vicinity of Chapala; his numbers include part or all of the series 3416–3488. In 1903, after Rose and Painter had left for Mexico City on October 7, Holway made a trip by rail, south at least as far as Sayula (October 8) and Zapotlán (October 9). He collected near Guadalajara on October 12, then went directly to Mexico City, which place he left on the 14th to join Rose for an ascent of the Nevado de Toluca. His collections in 1903 include, in addition to those noted above, numbers from about 5090 to 5200, not inclusive. See a note by Rose (Contr. U.S. Nat. Herb. 8: 281. 1905).

Hoogstraal, Harry. See Leavenworth.

Hooper, Emmet Thurman. In March, 1953, Hooper, a mammalogist from the University of Michigan, collected a few plants in the Sierra Fría, at a locality estimated to be 15 miles (24 km) west of Presa Calles, at an elevation of 2400–2500 m.

Hoover, David Beall. See McVaugh (1951).

Horton, Ovid B. See California, University of.

Hough, Walter. See Rose (1899).

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[1]Science II, 59: 139–140. 1924.

Howell, John Thomas. The Templeton Crocker Expedition of the California Academy of Sciences, on its return from the Galápagos Islands in July, 1932, touched at several places in our area. Howell, the botanist of the expedition, collected herbarium specimens as follows: Manzanillo, July 18 (10293–10295); Puerto Vallarta, July 20–21 (10296–10363); Punta Mita, July 22 (10364–10400). The specimens are in the herbarium of the Academy (CAS). I am indebted to Mr. Howell for the above information.

Iltis, Hugh Hellmut. In July and August, 1960, assisted by Robert Koeppen and Frank Iltis, Professor Iltis of the University of Wisconsin made a collection of more than 1300 numbers in southern Mexico. About 250 numbers were obtained in Jalisco and Colima, mostly along the highway from Jiquilpan to Manzanillo, but also in part from the mountains near Tapalpa. The first set of the specimens is at the University of Wisconsin (WIS), and a partial set of duplicates is at the University of Michigan (MICH).

Jackson, Raymond Carl. Jackson made a trip in the summer of 1957, "through various parts of Mexico and the Gulf Coast Area of the United States," primarily to study and collect material of the genus *Iva*. He collected briefly in Aguascalientes.[1] His specimens are at the University of Kansas (KANU).

Johnson, Miles F. Johnson travelled in Jalisco and Nayarit in 1966, primarily to collect materials for a revision of the genus *Ageratum.* The first set of his collections is at the University of Minnesota (MIN).

Johnston, Marshall Conring. In 1955 this collector traveled widely by automobile in northern Mexico and collected numerous herbarium specimens as part of a survey of certain oil-bearing plants. On July 13 he passed through the corner of Jalisco on the way to Aguascalientes, and collected nos. 2655–2656B about 10 miles southeast of Lagos de Moreno. On a second trip to Mexico he approached the Jalisco area from the north, and made collections as follows: 13 miles south of Aguascalientes, near the Jalisco line, October 2 (nos. 2856–2858); 3 miles north of Encarnación de Díaz, October 2 (2859–2864); 3 miles southeast of Encarnación de Díaz, October 2 (2865–2872); 10–14 miles northwest of Lagos, October 2 (2873–2877); 6–10 miles southeast of Lagos near the Guanajuato line, October 2 (2878–2880); Guanajuato, 6 miles northwest of León, October 2 (2881A–2882C); [nos. 2883–2902 collected, October 2–5, in Guanajuato, Querétaro and México]; Jalisco, or on the Guanajuato line, between León and Lagos, October 5 (2903–2910). Most of the approximately 43 collections from Nueva Galicia were representatives of Leguminosae or of Compositae. The best set of the specimens is at the University of Texas (TEX); other sets are at the Instituto de Biología (MEXU) and at Southern Methodist University (SMU).

Jones, Gwilym. With Professor J. Dan Webster of Hanover College, Jones collected in southern Zacatecas in 1964. A small set of specimens is at the University of Michigan (MICH).

Jones, Marcus Eugene (1852–1934). In the words of C. V. Morton (Contr. U.S. Nat. Herb. 29: 87. 1945), Marcus Jones "was an eminent collector whose specimens, usually well prepared, have been of great usefulness in making known the flora of the western United States. Also he published valuable notes and descriptions in many families of plants, particularly the Polygonaceae, Nyctaginaceae, and Liliaceae. He is well known also for his monograph of the difficult genus *Astragalus* of the Leguminosae."

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[1]Univ. Kansas Sci. Bull. 41: 800. 1960; Brittonia 15: 267. 1963.

Jones received his main support for many years from practical survey and assay work in field geology, and pursued his botany as an intensely absorbing avocation. He made three trips to Nueva Galicia, the first of which was in 1892. He became seriously interested in the flora of Mexico at a relatively late age, when in 1926 he began a series of collecting trips to that country. As a result of these trips he published a large number of new species based on his own collections. His work on Mexican phanerogams has been summarized by Morton, in the article cited above, and by Blake in a companion paper (op. cit. 117–137). To quote again from Morton, Jones' "work on the Mexican flora is poor and, in fact one is forced to say, comparable in quality only to that of Léveillé on the flora of China."

Jones' most important contribution to our knowledge of the flora of Nueva Galicia resulted from his trip of 1892, which was undertaken on behalf of General Wm. J. Palmer,[1] in order to inspect and report on various mining properties. In the course of this trip Jones visited a series of localities in a rather inaccessible area southwest of Lake Chapala. He made numerous collections in this area, and these are of unique interest for, as far as I am aware, the area has never been visited by any other botanist. Jones' diary covering this period is quoted below in full, with the kind permission of Dr. Lyman Benson of Pomona College. I have supplied dates and some comments which are inclosed in square brackets; otherwise the material is exactly as Jones wrote it.

May 22, Sunday. Spent the day at Irapuato. Visited the plaza & market place. Saw (at hotel) the first really fat Mexican ladies, very fat like Mrs. Houghton.

23 Mon. Strawberries .50 Wrote to Anna; Wrote to Lulu, etc. Left Irapuato for Guadalajara at 9 a.m. Reached G. at 4.45 p.m. Rode over the most fertile region I ever saw in Mex. Alt. 5400 G. is the finest city in Mex. that I have seen.

24 Tues. Express on boxes 17.00. 2 dozen photo plates 8.00. Cargador .12. Visited various individuals. Bought 2 doz. photo plates and developed 5. Called on the governor Mr. Wigand was very helpful. Stamps $1.00.

25 Wed. Left Guadalajara at 4.00 a.m. & went to Sayula. This is a pretty place by a lake among the lava mountains. Fruit .25

26 Thurs. Stayed at Sayula all day to see various people and get outfit for Tapalpa etc. Got a moso & 4 mules.

27 Fri. Left Sayula at 6 a.m. for Tapalpa. The ascent to 9000° alt. on the mts. is steep. Went from Tapalpa to Ferreria in p.m. Saw the good iron works at Ferreria. Slept there. The manager was very kind.

28 Sat. Left Ferreria for Chiquilistlan and reached there in p.m. with guide. Visited Mr. Vasques the [owner? word illegible] of the mines at C. He is a very pleasant man.

29 Sun. Spent Sunday quietly. Market day.

30 Mon. Left for the mines of Vasques saw 3 or 4 and slept at the Santa Maria. Fine scenery and deep cañons.

31 Tues. Returned from the Santa Maria mine & visited Vasques hacienda in p.m.

June 1, Wednesday. Left Chiquilistlan for Salsillo with guide. Saw one iron mine & 2 mercury mines. Slept at a ranch there. Rained at night. First rain of the season.

2 Thurs. Went over from Salsillo and saw the rest of the mercury mines and the "Colorado" iron. Then returned to Chiquilistlan and went over near the Santoninia mines and saw another iron mine, on the opposite (n.) side of the river. Got caught in a hard rain in the night returning. Got back at 9.30 o'c p.m.

3 Fri. Clear & bright after the rain. Wrote to Anna. Have also letters for Miss Winston [?] and father but cant send them yet. Left Chiquilistlan for Santa Cruz, traveled all day, & stopped for the night at a ranch 6 m. east. Country very rugged & breaks down to the west. No rain but threatened.

June 4, Sat. Reached Santa Cruz at 10 o'c a.m. Visited 3 mines in p.m. No good. Alt. 2650°. No rain.

5 Sun. Spent the day very quietly. Went down to the river to bathe. Quite warm, no rain. Our guide returned to his home.

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[1]William Jackson Palmer (1836–1909). Railroad executive. A general in the Union army in the Civil War. A participant in early railroad surveys, and with many holdings in Mexican railroads, 1872 to late 1890's. See Dict. Amer. Biog. 14: 195–196. 1937.

6 Mon. Visited the Santo Domingo mine. Very hot. Developed 12 views.
7. Tues. Left for La Palma in a.m. Reached there late in eve. The worst road of all. Ascended 3000° and down 1500°. Found many plants on the way.
8 Wed. Saw the San Rafael mine and stayed there all night as I had a bad headache.
9. Thurs. Returned from the San Rafael mine and saw the Mexicana & stayed all night at La Palma. Botanized a good deal. Our moso lost one mule by staying [straying?] away.
10 Fri. Left La Palma early with 2 pack animals & reached Tapalpa by noon. Ate wild ripe blackberries. Paper $3.50. Reached Sayula at 9 o'c p.m.
11 Sat. Shoes fixed 62 cts. 2 boxes .62 cts. Left Sayula for Zapotlan at 5 o'c a.m. Reached Z. at 8 a.m. Bargained for an outfit for Colima. Wrote about 12 letters.
12 Sun Stayed quiet all day.
13 Mon Left for the south at 10 o'c a.m. Went to Santa Cruz by night. Moso no good. Good animals. My mule got scared and bucked and broke my camera and barometer.
14 Tues. Went to the iron works and to Tamazula. Very dry.
15 Wed. Spent half a day at Tamazula & went to Tuzpan.
16 Thurs. Went to Rancho [Higuerro–word illegible]. Visited the Muerto mine. Very warm. Alt. 2300°.
17 Fri. Left Rancho Higuerro [Higuera] in a.m. & reached Pihuamo at 11.30 a.m. Pretty place. The jefe politico is very sick with a wound in the hip (bullet).
18 Sat. Returned from the Purissima mine & looked at the placeres in p.m. Botanized, very hot. Poured down in p.m.
19 Sun. Spent the day doctoring the sick jefe politico did not help him much.
20 Mon. Left Pihuamo at 7 o'c & reached Tonila at 3 p.m. Good road. Took 2 photos. Developed half a dozen. Had a headache in p.m. Tonila is larger than Pihuamo but not a large place.
21 Tues. Spent the day going to & returning from San Marcos. Botanized.
22 Wed. Went to Colima. Got 2 letters.
23, Thurs. Took train for Manzanillo at 7 o'c a.m. Reached there at 11 a.m. Took some photos, & botanized a little.
24 Fri. Rained all night. Went over to Stadden's ranch. Got many facts.
25 Sat. Botanized, & went over to Stadden's ranch & the sea. Took a bath and photos. Sacks etc. 1.50. Moso .25.
26 Sun. Went over to Stadden's ranch and to the sea. Breakers very high.
27 Mon. Spent the day at General Maltina's [Martínez?] ranch. Went up on a special. Ranch of 81000 acres [apparently Armería–R.McV.]. Many cocoa nut trees (2 kinds) bananas (2 kinds) pine-apples, corn, etc. Took several photos.
28 Tues. Moso .50 cts. Dillon[1] $1.00. Razor etc 4.40. Postage $1.00. Quinin .50 Pineapple .15 Returned to Manzanillo from Armeria, and then returned to Colima. Shipped 4 boxes by steamer to San Francisco.
29 Wed. Carbolic acid .15 cts. Moso 1.00. Spent the day doing very little. Developed 14 plates.
30 Thurs. Dillon 5.00. Towel 50 Got 3 samples of coffee from Mr. Vogle.[2] Did very little. Botanized a little. Developed some plates. Wrote to Anna.
July 1, Fri. Went early to see a saltpeter mine at Jayamita. Hot. Botanized.
2 Sat. Gave Dillon $5. Went to see a coal, mica and gypsum mine, only gypsum there. Hot. Botanized.
3 Sun. Spent the day at Colima.
4 Mon. Dillon $2. Went to see some marble at Rancho Magdalena. Rained very hard at night.
5 Tues. Dillon $10.00 Returned from seeing marble mine. Had a headache. Did not rain. Cloudy but no rain at Colima.
6 Wed. Japanese party left this morning. Moso $20.00. Button .02 Provisions 10.21. Hardware 2.38. Sacks .45 Get $150, of Hiebret. 3 spoons .13 Gum arabic 06 Coffee 1 lb. .37.
7 Thurs. Dillon $32.00 Left Colima in a.m. Reached Tonila at 2 p.m. Rained hard. Cloth for holders $1.00
8 Fri. Dillon $5. [word illegible] .28 Ferriage .75. Meals .18. stockings 50 Left Tonila at 7.30 a.m. for Pihuamo, reached there at 5 p.m. Got very wet. Dillon did his best to get me to not go. He has become very tiresome.
9, Sat. Moso 1.00. Dillon $50. Dillon decided to leave me here and return to Mexico, finding at last that he was of no service to me, a fact that I learned a month ago. Visited the Purissima mine & took samples. Left at 1 p.m. for Tonila against the advice & wishes of my friend

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[1]Dillon was apparently a helper hired by Jones some time before this, but I have not learned anything more about him. Relations between the two men worsened steadily until Dillon left, as the diary shows.

[2]This was evidently the German Consul, Arnold Vogel, at this time a resident of 25 years' standing in Colima. See Seler, Caecilie: *Auf alten Wegen in Mexiko & Guatemala*, p. 351.

Thiophilo Sanchez the jefe politico. Rained hard. Reached the Tuzpan all right. River too high to cross.
10 Sun. Crossed the river early and reached Tonila at 9 a.m.
11 Mon. Moso for Tonila 3.37. Ferriage .56. Tried to get outfit to start for the Volcano today but could not. Botanized. Rained hard yesterday & in the night. [3 words illegible; looks like "advance muy grande"] $3. A meals $1.50 Room 1.87. Cake & bread 2.50
12 Tues. Left Tonila at 4 o'c A.m. for the Volcano. Traveled till 12 o'c and then was about 1 m. [1 mile] from base of volcano but above it. 9250° alt. ±. Deep barranca between. Guide & I went over to Volcano & back in 4 hours. Had a bad headache. Magnificent view. Saw the sea.
13 Wed. Very cold in the night. Broke camp at 7.30 a.m. and ascended to 10500° alt. at pass on north side of Nevada de Colima & descended nearly to base of Mt. by 5 p.m. Rained for 2 hours, everything wet on the ground. Camped under a madrona tree on the grass. Rain eased at 6 p.m. Not cold.
14 Thurs. Moso 1.75 + for meals .50 Guide meal .25 Mules .50 Food Mules 3½ days $4.00 Paid for Colima mules $13. Sacks .05 Meal .37 Advanced moso $4.00. Feed etc. for moso $1.40. Left camp at 7 a.m. & reached Zapotlan at 11. Left Zapotlan at 2 p.m. with old Juan & 4 animals for Guadalajara. Reached Sayula at 7.30 p.m.
15 Fri. Room & 2 meals $1.00 Breakfast (3) .68 Moso feed 1.37 Left Sayula at 5 a.m. Rode all day to Sacoalco. Collected some. Warm in p.m. Reached Sacoalco at 4 p.m.
16 Sat. Meals & room self & moso & boy over night $2.00. Balance for moso $4.50. Feed, etc. .50.
17 Sun. Called on Mr. Kiff[?] who gave me letters & a telegram from Lynds that father is very sick. Called on Mr. Howland the Cong. minister. Took tea with him. Went to English service! First since April 11th.
18 Mon 2 boxes 1.50 Papers .25 Cargador .50 Stamp .02 Hotel $2.50 R.R. fare 5.75. Actual $13? Drew on Genl. Palmer for $110. 155.34 Mex. Meals $1.50 Fare $1.19 Left Guadalajara at 9 a.m. & went to Irapuato & Celaya. Telegram came for me to Irapuato but could not get it.

The herbarium specimens collected by Jones in 1892 included at least 543 numbers, arranged systematically before numbering. Some collections made in Zacatecas in April and early May were put in the same series. In the typewritten itinerary prepared by Jones himself, and now at Pomona College, he says "The Mexican trip was one for geological exploration for proposed railroads and to report on a certain group of such roads already in operation, botany was a side issue and I had to get specimens as my other business would allow. For this reason I got only about 5 specimens of a kind, and never could work up a flora as was my wont" (Jones mss., p. 21). On the following page he says: "The plants collected on this trip were put up in 3 sets." The principal set is in Jones' own herbarium, now at Pomona College (POM), and nearly complete sets are in the U.S. National Herbarium (US), and in the herbarium of Michigan State University (MSC).

Marcus Jones returned to Nayarit and Jalisco 35 years after his first visit in 1892. His trips from 1926 through 1930 have been summarized by Morton;[1] in the same publication a critical analysis of Jones' work on the Mexican flora is presented by Morton and Blake. The collections made in Mexico in 1927, according to a statement by Jones,[2] include his numbers 22835 to 23567. In his 15th Contribution to Western Botany Jones gives two accounts of his work in Nayarit (pp. 88–90 and 115–118), where he botanized at three localities, namely Tepic (8–16 February), Ixtlán (18–19 February), and La Barranca (21–23 February). He travelled by rail between these points.

In November, 1930, Jones came to Guadalajara by train from Tepic, and spent 17 days there, collecting every day that he could in "the barranca." His own account of his visit to Jalisco is in his Contribution No. 18.[3] He states that he collected a few specimens at La Barranca, Nayarit, when the train was delayed there for some hours on November 12, the day on which he reached Guadalajara. He botanized in "La Barranca" east of Guadalajara, and also on the plains in and near the city, from

[1]Contr. U.S. Nat. Herb. 29: 89–91. 1945.
[2]Contr. West. Bot. 15: 76. 1929.
[3]Jones, Extr. from Contr. West. Bot. 18: 113–118. 1933.

November 14 to November 25. About November 27 he went out to Orendain on the train, and botanized in the vicinity that day and part of the next. On the 30th he left by train to Tepic and Mazatlán. As far as I can learn there is no published statement of the number of collections made by Jones in 1930, but for specimens collected in Jalisco his field-numbers include at least the series 27051 to 27845, arranged apparently in the order of cataloging, rather than in strict chronological order.

Most of Jones' botanizing near Guadalajara seems to have been done in the Barranca de Oblatos or Barranca de Colimilla, more east than north of the city. On his first visit (November 13) he hired an auto to take him out to the *barranca,* "where the Lerdo [sic] river makes a hairpin curve at the junction with the Satiago [sic]." Later he refers to going down the "tram," and to "huts" and "eating booths" at the top of the declivity, by which he must mean the spot from which a cable-car leads down to the power-plant at Las Juntas. In his journal for November 25 he says: "Got out to the barranca by 8.30 and went at once to the bottom at power plant and then south [i.e. up-stream] to where the trail comes nearest the river, and then back to the top by 1.30, and got a big and heavy load of stuff." Day after day, while working out of Guadalajara, Jones at the age of 78 descended into the precipitous *barranca* and climbed out again with his load of specimens; the climb from the river is more than 500 meters, nearly straight up, and it is not surprising that he "felt some tired" after his longest day, when he reached the *barranca* by 8.30, went down to the river and climbed back with his heavy press, and finally reached home after dark.

The most nearly complete set of Jones' later collections is at Pomona (POM). Many duplicates are at the U.S. National Herbarium (US) and the Gray Herbarium (GH).

Jouy, Pierre Louis (1856–1894). A few collections from Jalisco, some labelled "Guadalajara," are in the United States National Herbarium. The collector, a member of the staff of the U.S. National Museum, was sent to Mexico to make special natural history collections. He traveled in central Mexico for nearly twelve months. At least from January 9 to September 6, 1892, he worked in Jalisco, principally in and near Guadalajara.[1] He made excursions to Chapala (mid-February) and to the Hacienda of El Molino (early June), and in the "latter part of March" he undertook a longer trip, on horseback, to Zapotlán and San Marcos. He collected birds about San Marcos and the Barranca de Beltrán ("Veltran"), March 24–29, and between San Marcos and Atenquique, presumably on his return trip to Zapotlán, on April 1. His plant-collections were neither numerous nor well-documented; his principal interests, and the collections resulting therefrom, were in zoology and ethnology. A short obituary notice appeared soon after his death (Auk 11: 262–263. 1894).

Karwinsky von Karwin, Wilhelm Friedrich (1780–1855). According to a report by Martínez (An. Inst. Biol. [Méx.] 23: 79. 1953), Karwinsky collected *Quercus candicans* at Tecatitlán, Mpio. de Manzanillo, Colima, in September, 1827. This record was based on a report by Trelease (Mem. Nat. Acad. Sci. 20: 203. 1924), where the locality was given as Tescatitlan (the State not mentioned). Professor Martínez later informed me that he believed the locality to have been in Oaxaca, and the correct spelling Tescaltitán. If the date of September, 1827, is correctly reported, however, the specimen probably came from somewhere in the State of Mexico as in that month Karwinsky made a trip from near Toluca to Sultepec and the nearby Mina de Cristo, returning to México in October.

Kempton, James H. See Collins.

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[1] Jouy, P. L. Notes on birds of Central Mexico, with descriptions of forms believed to be new. Proc. U.S. Nat. Mus. 16: 771–791. 1894.

Kerber, Edmund (–). Kerber, a young German botanist, spent at least two years in Colima and made considerable collections of herbarium specimens of which the principal set, 375 numbers, was sent to Berlin.[1] In two papers published after his return to Germany in 1881, Kerber gave an interesting account of his ascent of the Volcán de Colima (April 14–16, 1881), and a sketch of the vegetation on the mountain.[2] In April, 1882, he communicated a paper on phyllotaxy to the Academy of Sciences in Berlin,[3] and in May of the same year he left on a second trip to Mexico with the intention of selling sets of plants with the aid of the well-known Austrian entrepreneur, Keck. Part of the trip was financed by the Botanical Garden of Berlin, and a larger part, at the request of Eichler, by the Academy of Sciences. First results of the trip were announced by Eugène Fournier,[4] in a list of 50 species, including several novelties, collected by Kerber at Córdoba, Veracruz, in July and August, 1882. The results of the trip as a whole, however, were disappointing to the sponsors. The herbarium specimens included 300 numbers only, and the living plants intended for German gardens were neither rare nor successfully shipped, so that Eichler, as Urban noted, "verlor für immer die Neigung zur Ausrüstung ähnlicher Expeditionen" (Urban, op. cit. 53).

Little is known of Kerber's first trip to Mexico except what can be inferred from statements in the literature. Urban (op. cit. 362) gives the year 1878 as the beginning of the collection from the vicinity of Colima. Kerber was collecting there in September and October, 1879, as indicated by specimens cited in various places[5] and, according to his own account[6] he was at the same locality in December of the same year. He is also known to have made collections near Colima in June and November, 1880.[7] In describing his ascent of the Volcán de Colima in April, 1881, he stated that he had spent nearly two years in the city of Colima, and had often made excursions to the highlands of the volcanoes. He had studied the vegetation on both landward and seaward sides of the volcano, and contrasted these. He was impressed by the luxurious vegetation, including many species of orchids, on the southern and southwestern slopes, in the vicinity of the Hacienda de San Antonio. From the numerous species of orchids he recorded[8] from the "Seeseite" near San Antonio it may be inferred that this was one of his favorite collecting localities.

On April 12, 1881, Kerber prepared for an ascent of the active volcano, which had been in maximum eruption during the preceding month.[9] The winter had been cold, and at times the volcano had been covered with snow nearly to the foot. The first night was passed in Tonila, in the southeastern foothills, at an elevation of about 1250 m. The next day Kerber's party began the climb by way of Gachupines rather than by the somewhat longer alternative route by Hacienda San Marcos and the Barranca de Beltrán. They entered the pine forest near Gachupines, about one and one-fourth hours ("5/4 Stunden") above Tonila. They ascended to the edge of the cinder cone, thought to lie at about 2500 meters elevation, and on the 16th returned to Tonila.

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[1]Urban, I., Gesch. K. Bot. Mus. Berl. 362. 1916.

[2]Eine Besteigung des Vulkans von Colima in Mexiko. Verh. d. Ges. f. Erdkunde 9: 237–246. 1882; [Über die untere Niveaugrenze des Eichen- und Kiefernwaldes am Vulkan von Colima]. Verh. Bot. Ver. Prov. Brandenb. 24: 34–41. 1882.

[3]Die Lösung einiger phyllotaktischen Probleme mittels einer diophantischen Gleichung. Sitzungsber. Akad. Wiss. Berl. 1882 (1): 457–473. *pl. VIII.* 1882.

[4]Bull. Soc. Bot. France 30: 180–188. 1883.

[5]Fedde Repert. Sp. Nov. 17: 322. 1921; Bull. Herb. Boiss. 7: 409. 1899.

[6]Jacaratia conica, n. sp. Jahrb. k. bot. Gart. Berl. 2: 279–284. *pl. IX.* 1883.

[7]Kew Bull. 1936: 373. 1936; Ann. Missouri Bot. Gard. 1: 279. 1914.

[8]Verh. Bot. Ver. Prov. Brandenb. 24: 38. 1882.

[9]For records of this and other eruptions of Colima, see Arreola, José María, Catálogo de las erupciones antiguas del Volcán de Colima. Mem. Soc. Sci. "Antonio Alzate" 32: 443–481. 1915.

The collections made in Colima by Kerber have been relatively little studied. Of those cited in literature, however, a high proportion have been described as new to science. Some few duplicates of his collections were distributed, but presumably most of his specimens were lost at the time of the destruction of the Berlin herbarium in 1943. Dr. G. M. Schulze kindly informs me that if any record of the species in the Kerber collection was ever kept, it was doubtless destroyed at the same time. Specimens in other herbaria will be of much value, in years to come, in the interpretation of species previously based on the Berlin specimens, and the data on existing specimens will be of particular value in identifying Kerber's collecting localities.

Kiener, Walter. Dr. Kiener, formerly Biologist of the Nebraska Game, Forestation and Parks Commission, collected cryptogams in some of the *barrancas* near Guadalajara in December, 1944. On the same trip he collected elsewhere in southern Mexico.

King, Robert Merrill. While a graduate student at the University of Michigan, King collected independently in Mexico, mostly in Oaxaca, in 1958, and again with Charles Feddema (q.v.) in 1959. On this second trip the specimens from Nueva Galicia were assigned Feddema's numbers. The first set of all these collections is at the University of Michigan (MICH). In 1960 King collected for the University of Texas (TEX), mostly along the highways, in Jalisco and Nayarit, August 7–9 (nos. 3649–3664, mostly near Jiquilpan, Guadalajara and Tequila), and August 10–12 (nos. 3665–3704, mostly near Ixtlán del Río, Compostela and San Blas). In 1961 King collected with Thomas R. Soderstrom in Michoacán, in October and November. Nos. 4583–4689 were taken on Cerro Potrerillos, said to be 5 miles [8 km] north of Cotija and about 22 miles south of Jiquilpan. The collections were distributed under the names of King and Soderstrom, but the numbers were those of King's series. The first set is at the United States National Herbarium (US); a duplicate set of this collection, as well as that of 1960, is at the University of Michigan.

Kluge, H. C. This collector sent to Professor Samuel J. Record, of the Yale School of Forestry, approximately 20 specimens collected in September, 1924, in the "mountains about 30 miles from Tepic." The elevations are given as varying from 1000–4000 feet, but no specific localities are cited. The entire collection, which is now part of the holdings of the School of Forestry, included 20 numbered samples. There are herbarium specimens for nos. 1–6, 12–15, 17, and 20, and the corresponding wood samples (Yale nos. 7609–7625) for most of these. Perhaps the most interesting is no. 10 (7618), represented by a wood sample only; this is *Juglans* sp., of which the collector wrote: "This is black walnut. I was surprised to find it there. I was not able to see a woods or forest of it near Tepic. It was at an altitude of about 4000 ft. The trees grow large and it is used for lumber."

Knobloch, Irving William. Professor Knobloch, of Michigan State University, collected a few plants while passing through the northern part of our area in 1960.

Koelz, Walter Norman. See McVaugh (1959). Koelz, in addition to the plants collected jointly with McVaugh, collected independently in his series 34000–34277, in Colima and southern Jalisco. Of these, 115 specimens of vascular plants are in the herbarium of the University of Michigan (MICH).

Koeppen, Robert. See Iltis.

Lamb, Frank Haines (1875–1951). Lamb, a student at Stanford University (then Leland Stanford Junior University) in 1894, took the part of botanist in an expedition

to Mexico led by David Starr Jordan.[1] After Jordan's return to California, Lamb continued alone, and collected a large series of herbarium specimens in Sinaloa and Nayarit, mostly at localities near the stage line between Mazatlán and Tepic.

Lamb's initial connection with the Jordan party, as related in his memoirs, came about through the agency of Professor William R. Dudley, the then newly-appointed botanist at Stanford:

> Either [Dr. Jordan] or Professor Dudley suggested that a botanist could go along to gather duplicate botanical specimens which then could readily be sold to a number of leading herbaria in the world and in this way expenses of the trip could eventually be earned. The idea strongly appealed to me and Professor Dudley borrowed and reloaned to me sufficient money to make the trip.

The expedition left San Francisco on December 18, 1894, by steamer, and reached Mazatlán, Sinaloa, on December 24. Lamb found the collecting poor in the lowlands near Mazatlán, so he at once took the stage southward to La Unión and Rosario. Because of the dryness of the winter season his collecting still suffered. He returned to Mazatlán to see Dr. Jordan and his party leave on their return trip to California, then resolved to continue his botanical work until the departure of the next steamer, a month later.

On his second, and longer, trip southward through the coastal plain, Lamb revisited Rosario, then continued to Escuinapa and Acaponeta. From the latter place he undertook a two-day trip on mule-back, to visit the site of a mine in the mountains, where his opportunities for collecting improved: "The second day's travel was up a narrow rocky defile beneath a luxuriant arboreal vegetation. My pressing case enlarged amazingly." After returning to Acaponeta, Lamb took the stage again, passing through Tuxpan and finally reaching Santiago Ixcuintla about February 7, 1895. Up to this point he had collected approximately 250 numbers, all in the lowlands and foothills north of our area.

From Santiago Lamb made another side-trip into the mountains in the hope of finding more species in the flowering condition at higher elevations. He traveled almost northeast, reached the Río San Pedro at San Lorenzo (10–15 km east of the present railroad station called Ruiz), then ascended to a place called Zopilote ("Zopelote"), said by him to lie among the lower ranges of the Sierras at an elevation of 3000 feet. Here he found a more satisfying variety of species; he collected nos. 554–579, and perhaps other numbers, at Zopilote, February 9–12. He then returned to Santiago and continued by stage, via Navarrete, to Tepic.

Tepic, where Lamb found himself about February 15, was a poor place botanically in this the height of the dry season, so almost at once he hired a muleteer to pack his baggage and his accumulated plant-specimens to the coast at San Blas, whence he took the regular monthly boat to Mazatlán and so on to San Francisco. He seems to have left San Blas about the first of March, and according to his own account he returned to Stanford about the middle of that month. His plant-collections from Tepic and San Blas together include the numbers from about 580–624.

The plants collected by Lamb were numbered by him in the field, in the order of collection, from 1 to about 326. A set[2] was sent to the Gray Herbarium for identification. Presumably most of the determinations were made by M. L. Fernald, who returned a list of the names to Lamb (the list, in Fernald's handwriting, is

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[1]Much information relative to the expedition, and to Lamb's part in it, has been obtained from manuscripts I have seen through the kindness of Mr. George E. Lamb, of Hoquiam, Washington. These records include excerpts from the unpublished memoirs of Frank H. Lamb, and many notes dating from the period of the expedition of 1894–95. Interested readers may consult also Jordan's autobiography, *The days of a man,* volume 1, pp. 526–535 (1922).

[2]About 290 numbers were included in this set, according to Lamb's letter to B. L. Robinson, March 31, 1895.

preserved among Lamb's papers), and published, later in the same year, a report on some of the novelties.[1] The list as returned by Fernald bears the original field numbers, but for some reason unknown to me Lamb renumbered the entire collection before making it up into sets for distribution. In the sets as they were distributed with printed labels to the subscribers, the lowest number is 309 (i.e., field no. 1, the first collection made). Nos. 1–43 were correctly renumbered, 309–351. In the next 65 numbers, however, certain ones of the new series were used more than once, and a new sequence was established: Field no. 109 became no. 407, and this relation was maintained to the end of the series, so that nos. 109–326 are equivalent to nos. 407–624. The numbers under which the collection was distributed, therefore, are 309–624, with 10 numbers between 352 and 406 repeated. The entire collection included about 1916 specimens. The first eleven sets, not including the one sent out originally for determination, were distributed as follows (data from Lamb's records): 1. Stanford University; 2. Michigan State College; 3. E. L. Greene, Catholic University; 4. N. L. Britton, Columbia College; 5. Jardin Imperial de Botanique, St. Petersburg; 6. Botanisches Museum, Berlin; 7. Royal Gardens, Kew; 8. U.S. National Herbarium; 9. Herbier Boissier, Geneva; 10. T. S. Brandegee, San Diego, Cal.; 11. Thos. Meehan, Philadelphia.

Upon his return to Stanford, Lamb continued for several years his interest in botany. With Professor Dudley he travelled and collected in California during the summers of 1895 and 1896. In 1897 he botanized extensively in western Washington, and prepared a well-annotated catalogue of the flora. His interest in forestry having been aroused, he transferred about 1898 to study at the Biltmore Forest School at Biltmore, North Carolina. After a year in the East he moved to the Pacific Northwest, where he settled and entered the timber business, and where he ultimately went into the production of pulp, plywood and sawmill machinery. He was the author of numerous articles in trade journals, and of two books on trees.[2]

Land, W. J. G. See Barnes.

Langman, Ida Kaplan. While in Mexico in 1940 for a year's work on a bibliography of Mexican botany, Mrs. Langman spent more than a month in Jalisco. She made her headquarters in Guadalajara from mid-November until the last week in December, when she went by rail to Colima. A condensed account of this and Mrs. Langman's two other long trips to Mexico appeared in Asa Gray Bulletin II, 2: 291–296. 1954. During her visits to Jalisco and Colima in 1940, she made approximately 135 collections for the herbarium; these were in four sets, of which the first went to the Academy of Natural Sciences of Philadelphia (PH), the second to the Herbarium of the U.S. National Aboretum (USNA), the third to the Instituto de Biología of the National University of Mexico (MEXU), and the fourth to the Mexican Department of Agriculture. Following is a summary of her collections, which she kindly furnished for this paper:

JALISCO: Zapopan, 14 November (3078–3080); highway between km 732 and Tequila, 16 November (3081–3088); Colomo, near Zapopan, 18 November (3089–3090); Puente Grande, 19 November (3091–3096); Guadalajara–Chapala road, 21 November (3097–3106); km 11, Guadalajara–Tequila road, 25 November (3107–3114); km 49, Guadalajara–Chapala road, 27 November (3116–3124); road to S. Andrés, 3 miles east of Guadalajara, 30 November (3125); km 41, Guadalajara–Autlán road, 1 December (3126–3129); upper plateau, Barranca de Experiencia, 3 December (3131–3133); km 650, México–Guadalajara road, 8 December (3134–3144); Tlaquepaque to Puente Grande, 9 December (3145–3149); near Tequila, 10 December

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[1]Fernald, M. L. Undescribed plants from western Mexico collected principally by Frank H. Lamb in the winter of 1894–5. Bot. Gaz. 20: 532–537. 1895.

[2]Lamb, Frank H. Sagas of the Evergreens. [xiv], 15–364 pp. illus. Norton & Co., New York, 1938; Book of the Broadleaf Trees. 367 pp. illus. Norton & Co., New York, 1939.

(3150–3154); Barranca de los Oblatos, Huentitán, 11 December (3155–3159); west of Atequiza, 17 December (3160–3162); 14 miles west of Tepatitlán, 18 December (3163–3165); km 41, Guadalajara–Autlán road, 21 December (3166). COLIMA: Western outskirts of city of Colima, 25 December (3167–3180); SW of Colima, km 5 to Río Salado, 26 December (3181–3192); near Comala, road to San Antonio, 27 December (3193–3212).

Lape, Fred. In 1969 and other years Mr. Lape has collected Compositae and other plants in Colima, and near Apatzingán.

Laskowski, Chester Walter. See W. R. Anderson (1966), and McVaugh (1965).

Lay, George Tradescant. See Beechey.

Leavenworth, William Clarence (1917–1944). During the summers of 1940 and 1941 the members of the Hoogstraal Mexican Biological Expeditions spent five months in the area between Cerro Tancítaro and the Río Tepalcatepec. A few days the first year, and six weeks of the second, were spent collecting in the river valley, with the town of Apatzingán as headquarters. About 1600 collections were made in all. Collections made in 1940 were distributed under the name of Leavenworth; those made in 1941 under the names of Leavenworth and Harry Hoogstraal. Most of the collections were identified by Paul C. Standley at the Field Museum, Chicago (F), and a nearly complete set is deposited there.

During the first field season, and for six weeks of the second, the expedition made its headquarters in the village of Tancítaro, at the foot of the mountain of the same name, and during these periods attention was focussed on the flora and vegetation of the mountain itself. Below Tancítaro most of the collections were made near Apatzingán, or along the trail between Apatzingán and the village of Tancítaro (e.g. near Barranquillas or Acahuato), near Hacienda California, near La Majada, or along a transect south of Apatzingán toward Capirio ("El Capiri") on the Río Tepalcatepec. Some specimens were collected in "scrub forest" at localities said to be four miles, and 8 miles, respectively, west of Apatzingán.

The vegetation of the area was described, and most of the collections listed, in Leavenworth's posthumous paper edited by Theodor Just and P. C. Standley.[1]

Matuda (An. Inst. Biol. [Méx.] 24: 344. 1954) cites a collection made by Leavenworth at Guadalajara on August 26, 1941.

Le Jolis, ————. In Das Pflanzenreich IV. 83 (Heft 39): 103. 1909, under *Rivina humilis,* there is a report of this species from "San Blass," the collector's name given merely as Le Jolis.

Lemmon, John Gill (1832–1908). Mr. and Mrs. Lemmon collected a number of specimens in Jalisco in 1905, all as far as known from near Lake Chapala. The specimens are widely distributed; some are in the United States National Herbarium (US) (e.g. *Bommeria pedata*), some at the University of California, Berkeley (UC) (e.g. *Tephrosia leiocarpa, Asclepias chapalensis*), and a series of numbered collections including numbers up to at least 157 (*Thalictrum jaliscanum*) are at the Gray Herbarium (GH).

The locality-data are suspect on several of the Lemmons' collections from near Lake Chapala, and it may be that a series from some more arid locality elsewhere in Mexico was erroneously provided with the Chapala labels. Among the Compositae, for example, *Bahia absinthifolia, Parthenium incanum,* and *Zinnia grandiflora,* have all been reported from near Lake Chapala on the basis of Lemmon specimens, but none of these species is otherwise known from the area.

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[1] A preliminary study of the vegetation of the region between Cerro Tancítaro and the Río Tepalcatepec, Michoacán, Mexico. Amer. Midl. Nat. 36: 137–206. 1946.

Liebmann, Frederik Michael (1813–1856). *Pectis liebmanii* (the type, *Liebmann 467*), is reported as having been collected at San Augustin, Jalisco (Proc. Amer. Acad. 33: 83. 1897). The same record is repeated, but with the spelling changed to the conventional Spanish San Agustín, in Contr. U.S. Nat. Herb. 23: 1616. 1926. The locality is not in Jalisco, but on the Pacific Coast of Oaxaca, where Liebmann collected in 1842.

Longinos Martínez, José (–1803). See Sessé.

Longinos Vásquez, ————. See McVaugh (1960).

Longpre, E. Keith. Collected on Cerro Tancítaro in August, 1961, while engaged in a revision of the genus *Sabazia* (Compositae). The first set of his collections is at Michigan State University (MSC).

Loveland, Hugh Frank. See McVaugh (1958).

Lumholtz, Carl [Karl Sofus] (1851–1922). From 1890 to 1898 Lumholtz spent much time in field research in western and northwestern Mexico. His chief interest was in the study of the cultures of primitive peoples. During his early work in Sonora and Chihuahua he was aided by a number of scientific assistants.[1] On his third and longest Mexican expedition, which lasted from March 1894 to March 1897, Lumholtz traveled alone, without any scientific assistants. In the course of his work he collected a few plants, some of which are in the United States National Herbarium (e.g. *Dalea nutans,* collected at Santa Catarina in October, 1895). He came into our area from the north, in the early spring of 1895, and spent nearly a year among the Cora and Huichol Indians in Nayarit and northern Jalisco. During this period he made a trip to Zacatecas and worked for a time at Mezquitic, Jalisco. He came out to civilization at Tepic, and crossed Jalisco toward the southeast. He studied the Indian cultures in the area of Tuxpan before continuing into Michoacán, sometime in the month of August, 1896. His work in Nueva Galicia is described in *Unknown Mexico,* volume 1, pp. 484–530, and volume II, pp. 1–359. A map of the author's route is included in each volume.

Lundell, Cyrus Longworth. In carrying out investigations for the Rubber Development Corporation of the United States Government in 1943, to determine the sources of *chilte* gum in Mexico, Lundell made collections of *Cnidoscolus* in eleven states, including Nayarit and Jalisco. A report on the botanical aspects of the work appeared in 1945.[2] Lundell's travels took him to Durango in April, 1943; he was in Sinaloa in May, and early in June went in by plane to Puerto Vallarta, Jalisco, one of the centers of local production of the *chilte* gum. His collections there included nos. 13028–13036, and were made on June 8 and 9. The first set is in the Lundell Herbarium at the Texas Research Foundation, Renner, Texas (LL); a partial set is at the University of Michigan (MICH). On June 14 and 15 Lundell collected near San Blas, Nayarit (nos. 12171, 12172); soon after this he returned to eastern Mexico and began work in the state of San Luis Potosí.

Luz Font, ————. Collected in Guadalajara in September 1925 (Matuda in An. Inst. Biol. [Méx.] 24: 310. 1954).

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[1]For a popular, yet definitive account of the travels of Lumholtz in Mexico, see his *Unknown Mexico,* published in two volumes by Charles Scribner's Sons, New York, 1902. Publications resulting from his early work are listed in the first volume, pp. xv–xvi. The material which is of most interest to botanists is contained in the following article: Robinson, B. L., and Fernald, M. L. New plants collected by Messrs. C. V. Hartman and C. E. Lloyd upon an archaeological expedition to northwestern Mexico under the direction of Dr. Carl Lumholtz. Proc. Amer. Acad. 30: 114–123. 1894.

[2]Lundell, Cyrus Longworth. The genus *Cnidoscolus* in Mexico: New species and critical notes. Bull. Torrey Bot. Club 72: 319–334. 1945.

McVaugh, Michael Rogers. See McVaugh, Rogers (1957).

McVaugh, Rogers. Since 1949, in the course of 10 long expeditions and several short visits, I have spent approximately two years in the field in Nueva Galicia. The expeditions have been supported generously by the Faculty Research Fund of the Horace H. Rackham School of Graduate Studies, University of Michigan, by the Office of Research Administration of the same University, by the University Herbarium, and in recent years especially by the National Science Foundation, Washington, D.C. Since 1951 I have tried to plan fieldwork with the ultimate benefit to the Flora Novo-Galiciana always in mind. Because much of the terrain is rough and many localities are relatively inaccessible, it has not been possible to make systematic collections covering the entire area, as for example might have been done in a flatter and more densely settled area. Choice of collecting localities has been dictated to a large extent by the condition of the roads in individual areas. Although it is usually possible without much difficulty to reach remote localities in Mexico with pack-animals, the expenditure of time is disproportionately great, and the difficulties in drying, safeguarding and transporting more than small quantities of specimens are considerable. I have concentrated rather on making repeated visits to selected localities at different seasons, electing to sample fewer localities adequately in preference to making fewer collections at more widely scattered places. Moreover, critical areas that are at the same time inaccessible are rather few in Nueva Galicia, and with rapidly accelerating construction of new highways are becoming increasingly fewer. All the principal vegetation-types may now be studied along both primary and secondary roads. Paved roads, except those into Guadalajara from east and west, were almost non-existent in 1949, but in 1970 most towns of any size, except some of the most remote, were accessible by all-weather highways. Most of our fieldwork has been done with small trucks equipped with a closed body, 4-wheel drive and oversize, heavy-duty tires, but more and more it is becoming possible to reach botanically interesting areas, even in the back country, with an ordinary automobile.

Before the commencement of fieldwork by parties from the University of Michigan, few places in Nueva Galicia were well known botanically. About 1955 I estimated that about 12,000 individual gatherings had been made by collectors up to that time. This amounted to about two gatherings for each species in the area. Up to 1955 about 5000 different gatherings or collections had been reported in the literature from Nueva Galicia; about 1500 of these reported were from the vicinity of Guadalajara, about 750 from Tepic and vicinity, about 700 from Colima and Manzanillo, about 450 from central Jalisco between Tequila and Chapala, about 150 from the Nevado de Colima, and (rather surprisingly) about 500 from the inaccessible ridge-and-*barranca* country from Bolaños to northern Jalisco and adjacent Nayarit and Zacatecas. Mrs. Mexia had secured almost 600 numbers in the vicinity of San Sebastián, but except for her collections almost nothing was known of the botany of southern Nayarit and southwestern Jalisco. East of Guadalajara very little was known of the flora of Jalisco to the borders of Guanajuato and Michoacán. No important general collections had come out of Aguascalientes, since those of Hartweg (1837). The coastal deciduous forests extending from San Blas to southern Colima had scarcely been touched except near Manzanillo and to a lesser extent near Puerto Vallarta and San Blas.

Thus in spite of the existence of several thousand herbarium specimens in museums in Mexico, in the United States, and in Europe, it was not easy to determine the extent of the ranges of even common species, or to make routine identifications when so many species were known from the types only, or from a new imperfect specimens. We therefore began to assemble series of specimens from selected localities, concentrating in the early years upon the montane areas covered with fir, pine-fir and

pine-oak forests. In 1949, 1951 and 1952 we worked on the Nevado de Colima, including the northwestern, northern, eastern, and southern slopes, mostly at elevations from 2700 meters to timberline. In 1949 and 1952, and again in 1965, we explored the so-called Sierra de Manantlán, a rugged, isolated range west of the Nevado de Colima, between Autlán and the Colima border. The large area of forested sierras west and northwest of Ayutla has been explored in several stages: The Sierra de la Campana northwest of Los Volcanes in 1951 (briefly), 1952, and 1960; the various areas accessible from San Miguel de la Sierra (1952, 1960, 1962, 1965); the area surrounding the valley of Talpa de Allende (1952, 1960, 1965); the southwestern lobe of the pine forest near El Tuito (1970). The area near San Sebastián has not been thoroughly explored since Mrs. Mexia's visit in 1927. A little farther north, the upland forested areas of southern Nayarit were explored in 1951, 1957, 1960 and 1965. Farther east, we collected in the isolated Sierra del Halo, between Tecalitlán and Jilotlán, in 1957, 1959 and 1970; in the Sierra del Tigre, south of Lake Chapala, in 1952 and 1959; and in the mountains called on maps Espinazo del Diablo (mostly in the Municipio de Coalcomán, west of Aguililla), in 1958, 1965 and 1970. The Sierra del Laurel, on the border between Aguascalientes and Jalisco, was visited in 1959 and 1960; the Sierra de Tapalpa, southwest of Lake Chapala, was visited several times in 1960; and the pine-oak forests on the eastern border of Jalisco, between Arandas and Miguel Doblado, were explored in 1970, as were (briefly) the mountains in southern Zacatecas between Jalpa and Tlaltenango.

Thus no major areas of pine-oak or pine-fir forest remain critically under-explored except for those in northern Jalisco and adjacent Zacatecas and northeastern Nayarit, north of the Río Grande de Santiago and west of the valley of the Río Juchipila. This is a country of deep dry *barrancas* alternating with precipitous more or less flat-topped and forested ridges. It is almost inaccessible except by air or by foot-trails. Additional collections from many localities are urgently to be desired, as there appears to be a great deal of local endemism in the area, and it seems also that the transition between the more northern floras of the Durango mountains, and the floras of the Sierra Volcánica Transversal, cannot be convincingly elucidated without more knowledge of the plants of this ridge-and-*barranca* country that comprises perhaps a fifth of the area of Nueva Galicia.

Exploration of the Pacific Slope

A belt of mostly hilly country that originally supported a dense deciduous or subdeciduous forest lies along the Pacific Coast from Nayarit to Michoacán, extending from the ocean back to the foothills where the forest changes to one of oak or pine-oak. This foothill country (even near the ocean) is prevailingly steep and rugged, the temperatures are high, the air is either uncomfortably dry or uncomfortably humid depending on the season, insect and other pests are numerous, and vegetational cover is dense. At least partly for these reasons, human populations in the area have not been large, roads have been few and poor, and exploration difficult. The area is in fact still inadequately known, in spite of recent efforts to sample the flora. As mentioned above, early collectors concentrated their efforts near the coastal towns of San Blas and Manzanillo. A few have worked briefly near Puerto Vallarta. Until the completion (about 1970) of a graded road between Puerto Vallarta and Barra de Navidad, the coastal lowland there for a distance of more than 200 km was entirely unknown botanically, and it has still been explored only superficially.

On the then very newly graded road over the mountains from Autlán to La Resolana, we collected in the lowland forests in April 1949 and in April 1951; Wilbur collected in the same area in July and August, 1949, and we returned there in

October, 1960. We collected in the coastal strip at various localities from extreme western Michoacán to Bahía de Navidad in 1957 (June–August), 1959 (November–December), 1960 (October–November), 1965 (March), and 1970 (December). The lowland deciduous forest on the limestone and gypsum areas in Colima and adjacent Jalisco, and in the mountains west of Aguililla, was explored in 1957 (July), 1958 (September), 1959 (November–December), 1965 (March), 1970 (November–December). The dry upper valley of the Río Tepalcatepec was investigated in September 1958 (near Apatzingán), in February and March 1965 (between Nueva Italia and Arteaga, and between Tepalcatepec and Jilotlán), and in November 1970 (below Jilotlán). Mr. & Mrs. William R. Anderson collected early in 1970 along the road between Bahía Navidad and Puerto Vallarta, and in 1970 of the same year we spent 11 days collecting along the same route, mostly between Chamela and El Tuito. Farther north, in the Nayarit lowlands from Las Varas to San Blas, collections were made in 1957 (July, August), 1959 (November), 1960 (September). Almost any locality between the Pacific Coast and the mountains would repay further investigation, especially during the months from July to October.

Exploration of the Interior Basins and Uplands

The interior basins ("Cuencas Centrales" of Rzedowski and McVaugh, 1966) have been inadequately studied. The very flat country interrupted by low ridges, stretching from Ciudad Guzmán to Sayula, Zacoalco, Villa Corona and Magdalena has been heavily grazed and in part cultivated. Formerly there were extensive marshes around the shallow lake-basins, but many of the original habitats have been destroyed and it may be that some species have become extinct. Almost certainly some species have disappeared from the basin of Lake Chapala and the lowlands that parallel the lake on the north, because of the expansion of cultivated lands since the beginning of the present century. Almost no large collections have been made in any of the lake basins. In 1959 and 1960 we collected fewer than 100 numbers from the Laguna de Zapotlán and from the saline marshes near Acatlán and Villa Corona.

The rather dry interior hills and valleys support for the most part a deciduous forest, or a subtropical scrub characterized by a growth of tree Ipomoeas, *Acacia pennatula* and *Eysenhardtia.* Except for the grasslands of Aguascalientes and northeastern Jalisco, most of the upland (but non-montane) parts of Nueva Galicia are covered with deciduous forest or scrub. We sampled this type of vegetation in the high hills around Lake Chapala in 1957, 1958, 1959, and 1962. In 1958 we collected near Atotonilco el Alto, and in 1958 and 1959 in the valley of the Río Verde between Yahualica and Tepatitlán. In 1960 and 1962 we made small collections near Guadalajara, and north of that city toward the Río Grande. In 1962 I collected sparingly in Michoacán east of Lake Chapala. In 1960 we collected on the dry mountains and cuestas north and northeast of Autlán, and in 1962 I studied and collected sparingly in the thorn-forest between Totolimispa and Tonaya. In 1967 we collected in the mountains of northern Aguascalientes (east of Rincón de Romos), and in 1970 we worked along the eastern border of Nueva Galicia near León, and a little further south near Cotija de la Paz.

The grasslands of northeastern Nueva Galicia are much interrupted by rocky forested outcrops. Although much of the country is heavily grazed and some level areas are cultivated, many native species persist on the hills, about ponds and other depressions in the grassland, and even in some places on the open plains where grazing has not been heavy. In 1958 and 1959 we collected extensively from Ojuelos to Calvillo. In 1952, 1958, 1959 and 1970 we worked in the grasslands in the region between Lagos and Tepatitlán and Arandas. Small areas of grasslands near Guadalajara

and near Tepic were studied in 1957 and later years. In April 1951 we collected sparingly in the ridge-and-*barranca* country between Colotlán and Huejuquilla el Alto; in September 1958 we spent a few days near Huejuquilla, and in December 1970 we collected for a day in the deciduous forest in the lower hills between Jalpa and Tlaltenango.

The principal sets of our collections from 1949 to the present are deposited in the Herbarium of the University of Michigan (MICH), and in the Herbario Nacional del Instituto de Biología (MEXU) or in the herbarium of the Escuela Nacional de Ciencias Biológicas (ENCB). Duplicate sets are being distributed as identifications are completed.

Summary of Itineraries by Years

In 1949 my assistant was Robert L. Wilbur. We reached Mexico City on March 12, where we joined a group of zoologists headed by Dr. Emmet T. Hooper of the University of Michigan, and including Dr. Helmuth O. Wagner, a German ornithologist, long resident in Mexico. Our combined parties, after some days spent in Michoacán, travelled to Ciudad Guzmán, Jalisco, on March 23. On the 24th we crossed the great ridge north of the Nevado de Colima, by a primitive road (since then practically unused because of the opening of a new road from Atenquique northward around the east side of the mountain) and made camp on the northwestern slopes of the mountain near the settlement of El Izote, at the lower edge of the fir forest. We left this camp on March 31, and after returning to C. Guzmán, established a new camp on the northern slopes of the Nevado, in the pine-oak forest above a sawmill (abandoned in 1951 or 1952) called Piedra Ancha, which we reached from a point on the Atenquique-Jazmín road which was then building. Collections made on the Nevado de Colima, March 24 to April 2, included nos. 10010–10171.

Botanists and zoologists together left C. Guzmán and drove by way of the main highways to Autlán. A camp was established on the new graded highway to La Resolana, about 3 km north of that place and about 30 km southwest of Autlán. Collections (nos. 10172–10236) were made April 7–9, in the lowlands near camp and at various places above camp on the seaward slopes of the mountains and near the pass leading to Autlán. Returning to Autlán, we made arrangements for a pack-trip into the Sierra de Manantlán some 25 km (airline) to the southeast. We left Autlán on April 11, assembled our animals and gear in El Chante, and camped that night in the valley at the springs near the rancho called Manantlán. The following day we continued into the mountains and made permanent camp in a *barranca* near a large spring, at the lower edge of the fir-forest, at an elevation estimated at 2300 m. Collections were made here (nos. 10237–10341, April 12–16) and on the upper slopes of the mountains above camp. On the 16th we returned to El Chante and to Autlán as we had come.

In 1951, assisted by David B. Hoover, I worked five weeks in Jalisco and Nayarit. From Guadalajara we went directly to C. Guzmán; we established a camp on the Nevado de Colima, above Piedra Ancha where Wilbur and I had worked in 1949, but this time higher, in the fir forest not far below the zone of *zacatón*. Collections here were nos. 11600–11696, March 30–April 1. We then proceeded to Atenquique, where we took on supplies and a guide and drove out the Tonila road to a place where a lumber road (abandoned within a year after our visit) ascended the southeastern slopes of the Nevado to well within the fir zone. We camped, and collected nos. 11697–11796, 11822–11824, April 2–5. We then descended and continued around the mountain by a little-used road through Tonila to Colima, and then by the unpaved but graded road to Manzanillo, Cihuatlán, and Barra de Navidad, Jalisco. We spent the night of April 7 at a small hotel on the beach at Barra de Navidad, and the following day proceeded to Autlán by way of a truck road to Tequezquitlán and La Resolana

(April 7–8, nos. 11833–11912). April 9 we collected (nos. 11913–11962) in the mountains between Autlán and La Resolana, and the next day we went to Guadalajara. We then set out on a trip to northern Jalisco, by way of Yahualica and Teocaltiche, Michoacanejo and Aguascalientes. We passed through the city of Zacatecas, thence on April 15 to Villanueva, Huacasco and Colotlán. Retracing our steps to Huejúcar, we were guided to the summit of the Mesa de María de León and put onto the road across the high llanos to Monte Escobedo. On the 16th we reached Monte Escobedo, crossed the mountain to Mezquitic, ascended the pass north of this place and camped near the junction of the road to Huejuquilla. On the 17th we drove to Huejuquilla, but finding little of interest here on the high grasslands at this dry season, we returned to the "main road" and drove out to Valparaíso and Fresnillo, and the next day to Guadalajara. Collections made on the trip to the north, April 13–18, were nos. 11975–12039.

On April 20 Hoover and I set out on a trip to Tepic, by the usual highway. Making our base in Tepic, we drove to San Blas on the 21st, and to localities on the road to Jalcocotán on the 22nd. Collections made, April 20–22, were nos. 12040–12151.

Our last trip was from Guadalajara to Mascota, by way of Ameca. From Ameca on April 29 we took on an old road over the mountains via La Villita to Estanzuela, thence to a camp north of Mixtlán. On the 30th we proceeded to Los Volcanes, where we took the Ayutla-Mascota road and went on to camp in the pine forest of the Sierra de la Campana (so-called because of the huge rounded monolith with a "window" near the top, which dominates the pass through which the highway passed). On May 1 we went into Mascota and returned to camp; on May 2 we returned to Guadalajara by way of Ayutla and Tecolotlán. Collections made, April 29–May 2, nos. 12152–12237.

In 1952, assisted by Joseph Sooby, I worked approximately three months in Jalisco (and adjacent Michoacán) and Nayarit. A summary of dates, localities and collections has been published,[1] but the following notes may be of interest. We reached the borders of Jalisco on September 6; we made collections near Ojuelos and near Lagos, along the highways. We then drove from Guadalajara directly to a camp on the Nevado de Colima, with the intention of staying some days and exploring the summit and upper slopes. We found that continuing rains would prevent this, and we accordingly established a base at the Hotel Palmira at Jiquilpan, Michoacán, and from here spent a week (September 16–23) exploring the rich and varied flora of the pine forests in the Sierra del Tigre near Mazamitla, Jalisco. In spite of the heavy daily rains we made large collections there. A second visit to the Nevado de Colima (September 25) showed us that the trails were not sufficiently dry to permit the passage of a truck, and had indeed been much washed out since our earlier visit. We therefore undertook a series of trips out from Guadalajara with the object of studying the flora of various parts of the uplands in eastern Jalisco. We returned to Lagos, made a two-day trip into Arandas, and a short trip to Yahualica. On October 1 and 2 we worked in the rough volcanic debris of the mountains near El Molino, in a xerophytic flora rich in species. October 4–6 was spent on a trip to Tepic and Jalcocotán.

October 9, the weather having cleared somewhat, we made our third attempt at the Nevado de Colima, and spent several days on the mountain with good results but without being able to reach the summit. On the 18th we left the mountain and drove to Jiquilpan, stopping near Mazamitla for a survey of what changes had taken place in the flora in the month since our last visit, and on the 19th we returned to Guadalajara.

Wishing to re-visit the Sierra de la Campana, where Hoover and I had worked briefly in 1951, we drove to Ayutla and to a point a little beyond Cuautla on October 21. It had not rained for about two weeks, but the roads were not yet sufficiently

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[1] Asa Gray Bull. II, 1: 378–381. 1953.

good to permit the passage of busses. We made good collections in the forests of *Quercus resinosa* near Cuautla, then went on to my old camp in the Sierra de la Campana, where we spent five days (October 22–26) before returning to Guadalajara.

On our fourth visit to the Nevado de Colima, October 28–November 1, we succeeded in reaching the summit; a somewhat detailed account of this appeared in the Asa Gray Bulletin. We then on November 1 proceeded to Manzanillo by way of C. Guzmán, Zapotiltic, Tecalitlán and Pihuamo. Our intention was to make an expedition into the Sierra de Manantlán, by way of a truck road north of Santiago, maintained by the Aserraderos del Pacífico, of Manzanillo. We found the road as good as we had been led to expect, so that we were able to make the somewhat more than 80 km in six and one-half hours. An account of our stay (November 2–8) in this fascinating cloud-forest area, where we were drenched much of the time in spite of the lateness of the season, has also been published.

November 11–15 we spent in an all-too-hurried trip to an area of pine and fir forest known as Rosario, about 40–50 kilometers (by airline) southwest of Ayutla. The trip was arranged for us through the kindness of Ing. Agustín Gómez y Gutiérrez, of the Departamento Forestal in Jalisco, and Sr. José Luis Benítez, formerly of Guadalajara, who controlled the timber rights on the property. Our party included Sres. Benítez, Gómez y Gutiérrez, Sooby and myself, and Sres. Gregorio and Silvano Zorrilla, of Guadalajara, the *administradores* of the property. We took a little-used truck road, from Ayutla to San Miguel de la Sierra, where we had lunch. We then turned somewhat to the south and shortly entered the "Rosario" property. A sawmill called La Cañada, in elevation about 700 meters above Ayutla, lies in an opening in the pine forest, a broad *cañada* or shallow valley, in which grassland, or *zacatón,* prevails. From La Cañada by a very circuitous route across a ridge and down into a *barranca* we reached Agua Blanca, a sawmill and headquarters (37 miles [ca 60 km] from Ayutla by our measurements), where we were sumptuously, if simply, entertained by our hosts. On the 12th we crossed a very high and steep ridge and descended to the sawmill at Santa Mónica, where we collected in the rich moist fir forests before returning to Agua Blanca the night of the 13th and to Ayutla and Autlán on the 15th (our hosts had returned to Guadalajara the preceding day). The fir forest at Santa Mónica is notable not only for the richness of the flora, but for the low elevation (approximately 1900 meters) at which it flourishes.

On November 16, with the aid of our friend Miguel Santana V., of Autlán, we made an excursion to the mountain slopes above the pass which leads to La Resolana. This, to our knowledge, was the first time this area had been visited by botanists in the fall. Following this, Sooby and I, on November 17, set out for Talpa by way of Ayutla. The road having dried since our visit in October, we drove from Ayutla to Mascota in six hours, then spent the night of November 18 in Talpa, and arranged for horses and a guide to take us into the mountains. As related in the Asa Gray Bulletin, we collected in the Sierra de Cuale for four days, before returning to Talpa, Autlán, Ciudad Guzmán and Guadalajara. This ended our field work for the season, except for a visit which I made on December 7 to an area of springs and swamps near Villa Corona.

In 1957, assisted by John T. Mickel and Michael R. McVaugh, I spent two and one-half months in Nayarit and Colima, and southern Jalisco, mostly in an attempt to collect the common summer-flowering species of the Pacific lowlands. The first part of the season included several exploratory excursions into areas where the wet-season flora had not yet fully developed, and to localities that were visited and explored more adequately later in the summer. We came to Lagos, Jalisco, near the end of the dry season, climbed Mesa Redonda June 16, made a quick trip via Guadalajara to Jalcocotán and Mecatán beyond Tepic (June 18–19) and a similar excursion (June 20–24) southward from Guadalajara, via the then newly opened road from Acatlán de

Juárez, to Ciudad Guzmán and the northern foothills of the Nevado de Colima, thence via Atenquique and the paved highway to Colima and Manzanillo. At this time rains had begun between Tecalitlán and the coast. We collected in the lowlands along the road (then in process of paving) between Manzanillo and Cihuatlán. We returned through Colima to the Sierra del Halo, which we entered by a lumber road that leaves the highway about 11–12 km southwest of Tecalitlán; here we went in briefly up to the pine forest on June 23, and planned to return later. While I flew out of Guadalajara to a meeting in Ann Arbor (June 26–July 3) the assistants collected in the hills south of Lake Chapala. Our collections during this first part of the trip included nos. 14876–15130.

On my return we proceeded toward Tepic, stopping at Ahuacatlán, Nayarit, to take the new road over the mountains toward the southeast in the direction of Barranca del Oro, collecting in the Arroyo de la Fundición at an elevation of some 1300 m where there is apparently permanent water, and farther over the ridge in the oak forest (July 6–7). We then set up a base in Tepic and made daily excursions, including one to the vicinity of the hydroelectric plant on Río Ingenio (about 30 km north of Tepic), and another (July 9) to the south side of Cerro San Juan above Jalisco. Little was in flower in the pine forest. On July 10 we collected in the barranca below the Mirador del Aguila about 25 km north of Tepic. On July 11 we went by paved road to Compostela and on by the gravel road to Mazatán; the following day we returned to Mazatán and went on down the steep but quite acceptable road to Las Varas. The road from Las Varas to the coast was said to be "muy feo," so we returned to Tepic. On July 13 we visited the lava flows at the foot of Volcán Ceboruco, and the 14th we drove to Guadalajara. Our collections in Nayarit, July 6–13, included nos. 15131–15409.

Leaving Guadalajara July 16, for a trip of almost a month to the State of Colima, we found the lowlands were much greener than when we were there three weeks earlier, but still not fully in flower. On July 18 we went down the Manzanillo road to an area of limestone and gypsum rocks where the highway crosses the mountains about 11 miles (17–18 km) south-southwest of Colima at an elevation of about 500 m. Later the same day we established our headquarters on Santiago Bay, 8–10 km west of Manzanillo. From there we made excursions to Cuyutlán (July 22–23), to various localities on Santiago Bay and toward Cihuatlán, Jalisco, and on several occasions (July 27, 30, 31, August 1) toward the then-thriving sawmill town of Durazno, north of Santiago across the gorge of the Río Cihuatlán in Jalisco. Our collections included nos. 15409–15479 (southern Jalisco, July 16–17), 15480–15518 (between Colima and the Jalisco border, July 17–19), 15519–15576 (near the pass south-southwest of Colima, July 18–19), 15577–15800, 15847–15898 (lowlands up and down the coast from Manzanillo, July 21–30), 15801–15846, 15899–15987 (north of Santiago, in Colima and Jalisco, July 27–August 1).

After a trip (August 5–9) to Guadalajara, we returned to Colima. On August 9 we collected nos. 16016–16033A near Puente San Pedro (ca 8 km southwest of Tecalitlán; we had collected nos. 15437–15458 here on July 16). On August 10 we drove from Colima to Tecomán and beyond, as far as the Río Coahuayana, which was impassable for us, although some vehicles were being pulled across by tractors. On the 11th we drove from Colima to the old Hacienda San Antonio, which lies in the western foothills of the Nevado de Colima, about 30 km north of the city in a humid barranca at an elevation of about 1100 m.

For three days (August 13–16) we returned to the Sierra del Halo where we had prospected briefly on June 23. This time we ascended at once by the lumber road near Puente San Pedro, to the pine forest about 5 km above the highway, at an elevation of about 1500 m. Later we went in farther toward the center of lumbering operations, San Isidro, reaching an elevation of about 2000 m at a point some 22 km from the

highway and overlooking the town of Pihuamo (we discovered later that at this point we were only about 4 km from San Isidro, which lay beyond the summit).

Our collections included nos. 16034–16063 (near the pass south-southwest of Colima, August 10), 16064–16072 (lowlands near Tecomán, August 10), 16073–16117 (near San Antonio, August 11), 16119–16270 (Sierra del Halo, August 13–16).

After a trip to Guadalajara and Mexico City, we planned another excursion to Tepic. After collecting nos. 16275–16327 on August 24, in the grassy hills south of Santa Cruz de las Flores (where we had taken no. 14940 on June 20 and nos. 15414–15419 on July 16), we left Guadalajara on August 25. We collected again in the Arroyo de la Fundición (nos. 16328–16361). The following day we spent in the pine-oak forest near km 870, about 35 km southeast of Tepic (nos. 16362–16436). On August 27–29, from a base in Tepic, we collected in humid ravines in the oak forest about 14–15 km north of Compostela, at an elevation of about 1000 m (nos. 16437–16567). On August 30 we stopped at a prominent grassy hill near km 886, about 20 km southeast of Tepic (nos. 16568–16600). We reached Guadalajara the same day, and left for Michigan on September 1.

In 1958, assisted by Hugh F. Loveland and Richard W. Pippen, I concentrated on the flora of Aguascalientes and northeastern Jalisco ("Los Altos"), and visited for the first time the region of Apatzingán and the valley of the Río Tepalcatepec. From a base in the City of Aguascalientes we collected from August 8 until August 17 at various localities in the grasslands and semi-arid rhyolitic hills between Aguascalientes and Ojuelos. The rains were unusually heavy this year, and we found abundant vegetation even in the drier areas. Our collections included nos. 16622–17079. Nos. 16995–17040 were collected August 16, in a rich wooded canyon to which we were directed by Sr. Manuel Cortina Rivas, the proprietor of Hacienda Chinampas. August 18 we made an excursion to the Cerro de los Gallos northeast of Encarnación de Díaz, Jalisco, where on the dry oak-covered slopes and the grassland to the eastward we collected nos. 17080–17152.

After a short trip to Guadalajara, we moved our base of operations to the Hotel La Marina at Atotonilco el Alto, Jalisco, a town then newly accessible by paved road. The rocky hills are mostly oak-covered, and there are some intervening marshy areas. Nos. 17155–17248, and 17307–17336 were taken (August 22, 23, 25) from the vicinity of Atotonilco and the nearby village of Ayo el Chico. On August 24 we collected (nos. 17249–17306) in a flooded and nearly undisturbed meadow near km 58 from Zapotlanejo and about 11 km northwest of Totoltán.

On August 26 we moved to Hotel Navarro in Tepatitlán, Jalisco, and continued our excursions from that base, collecting in and near the barranca of the Río Verde north of the city (August 27–28, nos. 17337–17456). On August 29 we climbed to an elevation of about 2400 near the summit of Cerro Gordo, a prominent isolated elevation southeast of Tepatitlán, ascending by a trail from San Ignacio (nos. 17457–17530). On August 30 we collected nos. 17531–17556 on the bluffs between Jalostotitlán and San Miguel el Alto, and on our return made a side-trip to Capilla de Guadalupe where we discovered a small water-filled depression with a rich flora of aquatics. The following day we returned to this last locality; we collected nos. 17557–17587 in the vicinity. On September 1 we removed to our former base, the Motel San Marcos in Aguascalientes, collecting *en route* in the wet grassland depressions west of Lagos de Moreno, and in the eroded hills near San Juan de los Lagos (nos. 17588–17642).

Pippen and I left Aguascalientes on September 3 and drove to Fresnillo and Valparaíso, Zacatecas, whence we took the way through the grassland to a camp near the junction of the roads between Huejuquilla and Mezquitic, Jalisco. Here in the rocky hills at the summit of the *bajada* leading down to Mezquitic, we collected nos.

17643–17767 (September 3–5). The locality is about 5 km south of a rancho called Potrero de las Yeguas, and about 30 km southwest of Valparaíso.

After a hurried trip to Mexico City, our entire party returned to Aguascalientes on September 10, and to Guadalajara the next day. After necessary repairs to our truck, we drove to Apatzingán, Michoacán (via Carapan and Uruapan), and made our headquarters at Hotel Tapachula (September 13). We found the hot valley of Apatzingán in good condition after recent rains. We at once took the road for the mountains south of the Río Tepalcatepec, crossing the river (September 14) about 30 km west-southwest of Apatzingán and then following the road to Aguililla for 40 km before turning off to climb another 35 km to the lumber camp of Dos Aguas, which lies nearly west of Aguililla, in the pine forest at an elevation of 2000–2200 m. Below Dos Aguas, near the site of our camp, is the junction between volcanic rocks and limestone. We spent one night in the mountains, and returned to Apatzingán the next day because of worsening weather. For the next 3 days we collected in the valley, working out of Apatzingán in the grasslands and thorn-forests. On the 19th we returned to Jiquilpan. Our collections during the trip to Apatzingán included nos. 17818–17888 (road to Dos Aguas, September 14–15), and 17889–18040 (hot lowlands, valley of Apatzingán, September 16–19).

We concluded our field-work for this year by a short trip to Colima, September 20–22. We collected especially at two localities I had visited earlier in the season, in 1957, in the gypsum hills south-southwest of Colima (nos. 18046–18081, September 21), and near Puente San Pedro (nos. 18090–18137, September 22). From our base at Hotel Palmira in Jiquilpan we collected nos. 18142–18199 (September 23) on steep high hills above Lake Chapala, some 12 -13 km northwest of Sahuayo. The next day we went on to Guadalajara to prepare for the return journey to Michigan.

1959

Accompanied by the veteran collector Dr. Walter N. Koelz, I arrived in Aguascalientes on November 1. We found conditions in the high grasslands much less favorable for botanists than they had been in 1958 when the rainfall was unusually high. We arranged with Sr. José Velasco, who had lived in Calvillo as a boy, to show us the mountains near there, and on November 2 we set out for the Sierra del Laurel. The road was paved about halfway from Aguascalientes to Calvillo; from the latter town we went south a short distance through the guava orchards to Rancho Los Adobes, where we hired pack-animals. We returned on November 4 and ascended through deciduous woodlands into the oak-forests near the summit peaks at an elevation of about 2500 m. We descended the same day, by a different route via a precipitous stream-valley. On November 5 we went by a newly surfaced road via Teocaltiche and Yahualica to Guadalajara, collecting nos. 259–300 on the way. Our collections in Aguascalientes, all distributed under the names of the joint collectors ("*McVaugh & Koelz*"), were nos. 1–37 and 67–79 (between Ojuelos and Aguascalientes, November 1–2), between Aguascalientes and Calvillo (nos. 38–66, 80–161, November 2–3), 162–238 (Sierra del Laurel, November 4).

During a short stay in Guadalajara, we collected nos. 301–342 on the rocky *cuesta* above San Marcos on the lake of the same name, nearly west of the end of Lake Chapala (November 7). The next day we climbed the southern face of the mountains between Jocotepec and San Juan Cozalá, reaching an elevation of about 1900 m, and collecting nos. 343–391. We left Guadalajara on November 9 for a two-day trip to Jiquilpan and Mazamitla; we collected nos. 398–474 in the pine forests of the Sierra del Tigre where I had worked in 1952, then returned to Guadalajara on the 11th, and went on to Tepic.

From a base at Motel La Loma in Tepic, we searched for the late flora in the humid oak forests 14–15 km north of Compostela where I had collected in 1957 (nos. 477–586, November 12–13), and at other localities near Compostela (nos. 587–651, November 13–14). Also on the 14th we made a short trip up into the pine forest above Jalisco, some 9 km toward El Malinal (nos. 652–679). On the 15th we collected in the deciduous forest between Jalcocotán and the coast at Miramar (nos. 680–709), and at several localities along the road north of Tepic (nos. 710–727).

Leaving Tepic on November 16, we collected along the road from Ahuacatlán to Barranca del Oro (nos. 728–847, November 16–18), while camping in the oak forest near the summits of the ridge. We continued to Guadalajara on the 18th, and to Autlán on the 20th. Since my last visit to Autlán in 1952, the road had been paved as far as Cocula, and then from the bridge at Corcovado to Autlán and on to the ocean, leaving only a rough stretch of perhaps 75 miles unpaved. From a base at Hotel Valencia we collected on the seaward-facing slopes in the oak forest about 3 km below the pass and 14–15 km southwest of Autlán (nos. 848–899, November 21). On November 22 and 23 we drove about 11–12 km nearly south of Autlán to the small valley village of Ahuacapán, then ascended steeply to the south and southeast to the lumbering center of Corralitos, another 14 km by winding roads. We collected, mostly in the *barranca*-forests, nos. 900–1018. After collecting a few more specimens on the dry hills northeast of Autlán (nos. 1019–1037), we left the same day by the paved road to the coast.

We found the recent hurricane had left the Colima coast devastated. From Barra de Navidad, where the new Hotel Melaque was under construction, to Manzanillo, the damage to vegetation was very great. Whole stream valleys were washed completely clean and a gravel plain a mile wide left below; deciduous forests near Cihuatlán were almost unrecognizable, with trees by the thousands broken and leafless; the palm forests encircling Bahía de Santiago, where we had botanized in 1957, were almost gone; the trees did not overturn, but snapped off cleanly 6–10 m above the ground. Near Santiago and the Manzanillo airport the breakage was almost 100 percent, with nothing but a forest of great columnar stumps left standing. Manzanillo itself was full of rubble but recognizable, but a few miles further southeast the palm-groves were almost normal. We decided not to tarry here but to continue into the relatively undisturbed uplands, so proceeded to Colima, crossing the Río Armería on the railroad bridge because the highway span had been washed out.

On the next day, November 25, we collected in the gypsum hills south-southwest of Colima (nos. 1040–1079), but found the deciduous forest dry at this time. We set off for Guadalajara on the 26th, after collecting a few specimens in the valley of the Río Salado, 8 km southeast of Colima (nos. 1080–1102); we took the new road that led from below Tecalitlán to Atenquique, and another (newly paved) road from Ciudad Guzmán to Guadalajara.

We had arranged to meet Professor Faustino Miranda, who was coming from Mexico City, in Jiquilpan on December 1, so in the meantime we decided to revisit the Sierra del Halo, which I had never seen at this season. On the way we took a few interesting plants (nos. 1105–1121, November 28) from the Laguna de Zapotlán where the new road crossed it just north of C. Guzmán. We continued the same day into the Sierra del Halo as far as San Isidro (about 25 km from the highway), then returned a short distance and camped for 3 nights. We collected nos. 1122–1298. Here near the area where we had collected extensively in August 1957, about 20 km from the highway at an elevation of about 2100 m, Dr. Koelz found extensive stands of a species of *Podocarpus* in deep humid valleys surrounded by the pine forest on the higher hills. The forest here has been described briefly in *Ciencia* (Méx.) 24: 224. 1966.

We met Professor Miranda in Jiquilpan according to plan, drove to Colima on

December 2, and from our base at Motel Costeño returned on the 3rd to the Sierra del Halo to inspect the *Podocarpus* and other elements of the *barranca*-forests. The next few days were taken up with excursions to points near Colima, the most interesting new localities supporting characteristic deciduous forests over tumbled and eroded limestone rocks, 6–13 km southwest of Pihuamo. On December 9, after a visit to Tecomán and a trip over the newly paved road to Cerro de Ortega on the Río Coahuayana, we drove up the coast and settled at the Hotel Playa de Santiago on Santiago Bay. Our collections from near Colima included nos. 1299–1317 (Puente San Pedro, December 2); 1350–1378 (Sierra del Halo, December 3); 1379–1439, 1466–1536 (region of Pihuamo and from Pihuamo to Río Tuxpan, December 4–6); 1440–1465, 1554–1562 (southeast of Colima, December 5, 7); 1537–1553, 1563–1598 (gypsum area south-southwest of Colima, December 7–9); 1599–1616 (near Cerro de Ortega, December 9).

On December 10 we rode out to the north on the road to Río Cihuatlán and Durazno, which had been such a profitable area in 1957, but we found that the hurricane had made the road to the river all but impassable, broken and stripped the forest, and carried away the concrete bridge that had spanned the river. The next day we moved our headquarters to Barra de Navidad, and explored a new private road leading through forested hills to the beach called Playa de Cuastecomate, 8 km to the northwest. We made another trip to the beach area on the 12th, then moved to a camp in the *Brosimum-Orbignya* forest in the hills 14–15 km from the ocean on the Autlán road. We left camp on December 14, and returned through Manzanillo and Tecomán to Colima. On the 15th we drove to Jiquilpan, stopping at the limestone outcrops southwest of Pihuamo. Professor Miranda left for Mexico on the 16th, and Koelz and I began our trip to Michigan. Our last collections included nos. 1617–1637, 1672–1719, 1787–1792 (coastal lowlands, December 9–14); 1638–1671 (between Santiago and Río Cihuatlán gorge, December 10); 1720–1786 (near camp 14–15 km north of Bahía de Navidad, December 12–13); 1793–1800 (limestone areas southwest of Pihuamo, December 15).

1960

On August 23, accompanied by Charles Feddema and Richard W. Pippen, I arrived in Aguascalientes, where Professor J. Rzedowski of Mexico City awaited us. We spent the next two days collecting (nos. 18251–18345) in the high grasslands and rocky ridges 28–40 km west of the city. On August 26, by previous arrangement, and guided as in 1959 by José Velasco, we drove to Rancho los Adobes near Calvillo and took pack animals to ascend the Sierra del Laurel, reaching our camp in mid-afternoon. We spent two days and nights near the summits, returning to Calvillo and Aguascalientes on the evening of August 28. Our collections from this trip included nos. 18346–18453, and 18455–18478.

From Aguascalientes we made an excursion August 30, via Calvillo to just beyond Jalpa, Zacatecas, collecting nos. 18479–18516. The road since our visit last year had been paved to a point 6–8 km beyond Calvillo.

The next day, August 31, we drove to Guadalajara via Lagos to prepare for a trip to Tepic. In the course of the next two days we made short excursions, to the barranca at Presa de Santa Rosa north of Amatitán, to Ameca, and to the rough hills near El Molino, about at km 640, or 25 km southwest of Guadalajara. Our collections included nos. 18527–18611. On September 3 we drove to Tepic and made our base at Motel La Loma. We collected a few specimens (nos. 18612–18660, 18667) in grasslands near Tequila, and 18661–18666 between Tequila and Tepic.

From our base at Tepic we made various excursions, viz. on September 4 to the oak-pine forest near km 868 and 866, ca. 40 km southeast of Tepic, near where I had

collected in August, 1957 (nos. 18668–18730); on September 5 to swampy meadows and forested areas on the road to Compostela and beyond (nos. 18731–18761A), on the 6th to the coast via Jalcocotán and Miramar, and again toward Jalcocotán on the 7th (nos. 18762–18841). Dr. Rzedowski left for Mexico City this evening. From the 8th to the 12th we continued our explorations of the rich wooded ravines between Tepic and Jalcocotán (nos. 18843–18993). On the 13th we descended into the *barranca* below the Mirador del Aguila (nos. 18994–19008), and on the 14th we made a hurried trip to the coast near Chacala, ca 8 km west of Las Varas; the road from Tepic to Compostela was paved, but from there to Mazatán (ca 18 km) and down to Las Varas (25 km) it was rough; we collected nos. 19009–19029 during the day. On September 15 and 16 we drove over the newly paved road to Santa María del Oro, and the equally new graded road above the beautiful crater lake in the deciduous forest some 5 km further northeast (nos. 19030–19082).

On our return to Tepic on September 16 we were joined by Ing. Efraím Hernández X. of the National School of Agriculture. The next day Feddema flew by Aerolíneas Fierro to Jesús María in northeastern Nayarit, whence he returned September 24 with a collection of about 265 numbers. In the meantime Pippen and I, with Prof. Hernández, drove to Las Varas and continued south along the coast as far as we could practicably go. The roads were muddy and slippery, and although we were on the regular truck road to Puerto Vallarta, we saw no other vehicle during the 3 nights we camped below Las Varas. On leaving Tepic September 17, we camped the first night in the mountains some 11 km below Mazatán; collections this day included nos. 19083–19124, including many grasses chosen by Prof. Hernández. On the 18th we went about 10 km south of Las Varas in the coastal lowlands, then turned inland and began ascending toward La Cucaracha, a hamlet about 12–13 km east or southeast of this last road-junction and just over a low pass at about 400 m elevation. We camped in the *Orbignya-Brosimum* forest in these low mountains until the morning of the 21st, when we returned to Tepic. Our collections included nos. 19125–19262. On the return journey we collected nos. 19263–19300 in seepage areas in savannahs 3 km east of Las Varas.

On September 22 we made an excursion (collecting nos. 19309–19363) to extensive swampy meadows 6–8 km north of Compostela, that we had visited briefly on September 5. On the 23rd, while I drove to Guadalajara, Pippen and Hernández made a short trip to the beach near San Blas (nos. 19434–19451). On the 25th we collected nos. 19364–19393 in the ravines between Tepic and Jalcocotán, and on the same day Hernández and I took nos. 19394–19433 in inundated meadows near La Labor, some 35 km southeast of Tepic.

We assembled on September 26 in Guadalajara, where Prof. Rzedowski joined us again. After an excursion on the 27th to the alkaline lake basins south of Acatlán de Juárez (nos. 19452–19488), we drove the following day to Autlán, where we made our base as usual at Hotel Valencia. On the way to Autlán we collected nos. 19494–19530 in the alkaline marshes near Villa Corona. On September 29 the entire party attempted the road above Ahuacapán toward Corralitos, but the upper roads proved to be impassable and we worked in the pine forests up to an elevation of about 1800 m (nos. 19531–19643). On the 30th we drove up into the much drier mountains nearly north of Autlán, 5–8 km above the manganese mine called Mina de San Francisco; in the oak zone and the transition to tropical forest we took nos. 19644–19711. On October 1 we made a hurried excursion to Barra de Navidad, Cihuatlán, and Playa de Cuastecomate (nos. 19712–19746).

Prof. Hernández left for México the next morning (October 2), while the rest of the party collected on the *cuesta* above the bridge at Corcovado, some 25 km northeast of Autlán (nos. 19747–19794). On October 3 we made an excursion to the oak forest on the ridges some 5 km toward the coast from La Huerta, where we met

the owner of the property, Sr. Longinos Vásquez, and secured his permission to botanize (nos. 19795–19848). Our excursion on the 4th was to the seaward side of the pass between Autlán and the coast, where at an elevation of about 1000 m we investigated the grassland flora that seems to be maintained by grazing and burning (nos. 19860–19904, and in ravines lower down nos. 19849–19858). Prof. Rzedowski left for México early on the 5th (Feddema and Pippen driving him to Guadalajara), while I returned to the area above Mina de San Francisco (nos. 19905–19935). After the assistants returned, and after some delay for necessary errands and repairs to the truck, we revisited the ravines where we had taken nos. 19849–19858 on October 4, and made a fuller collection (October 7, nos. 19936–19987).

On October 9 we began the first of two long excursions to the mountainous regions of western Jalisco, near Talpa de Allende and between Talpa and Ayutla. The road to Ayutla, Cuautla, and Los Volcanes, which was indescribably bad when I passed over it in 1951 and 1952, had been graded in 1960 as far as the mountains (the "Sierra de la Campana") beyond Los Volcanes, where we camped the first night out of Autlán. On the way here we collected in the dry oak forest northwest of Cuautla (nos. 19989–20009), and the next morning we took nos. 20010–20067 near camp on the west side of the mountains. We left camp on the 11th and drove over the old road to Talpa, where we made our base in the hotel back of the municipal offices, the same in which Sooby and I had stayed in 1952. Once settled, we returned several times on successive days to the vicinity of the pass about 6–8 km back on the road to Ayutla and collected in the oak-pine forest and in a small sheltered valley above and north of the pass (nos. 20068–20199, 20201–20236, October 12–14; 20336–20374, October 17).

We were informed in Talpa that it was possible to drive over the mountains to the south of town, the road having been graded in order to facilitate the marketing of the coffee crop in La Cuesta, a small town at the foot of the range on the Pacific side. We set out on October 15, over a very rough muddy one-track road which crossed a branch of the Río Talpa and then began to ascend into the pine forest about 15 km south of Talpa, and crossed the pass about 4 km further on, at an elevation of about 1400 m. At the pass the pine forest gave way to a deciduous forest including several species of oaks (*Quercus*). The narrow and often dangerous but well-engineered road, built with many retaining walls, dropped steeply in another 13 km to La Cuesta, at an elevation of about 570 m. On this first trip we returned to a camp about two-thirds of the way to the top, and made our way back to Talpa on the 16th. Collections were nos. 20237–20248 and 20330–20335 in the pine forest, and 20249–20329 between La Cuesta and the pass.

After organizing our collections in Talpa, we returned on October 18th and 19th to the area where the Río Talpa emerges from the mountains as the road begins to ascend into the pine forest. We found that the clear stream came through a deep humid *barranca* with a characteristic flora including very large oaks, *Podocarpus,* and *Matudaea* of the Hamamelidaceae. In two excursions to this *barranca*-forest we collected nos. 20375–20413 and 20430–20461, taking as well nos. 20414–20429 from the pine forest nearby.

At this point our collecting in the Talpa area was interrupted by a trip to Mexico City, where we attended the first Mexican Botanical Congress. We made a few collections on the way out (October 20), including nos. 20468–20473 in a swampy meadow east of Los Volcanes. We returned from Mexico to Guadalajara on the 29th of October, then made several excursions from Guadalajara, including four over a newly paved road via Amacueca to Tapalpa. In the oak and pine forests along this road, we collected nos. 20477–20726, October 30 and November 1–3.

Leaving for Autlán on November 5, we collected nos. 20727–20741 in the broad inundated meadows north of Unión de Tula. We continued to the coast on November

6, and established our base at the newly opened Hotel Melaque on Bahía de Navidad. We made short excursions to the Playa de Cuastecomate which Koelz and I had visited with Miranda the year before (nos. 20742–20763, November 6); to Santiago via Cihuatlán, where the new bridge was being built (about half the concrete piers were in place) (nos. 20764–20812, November 7); to the edge of the foothills north of Bahía de Navidad (nos. 20813–20903, November 8–9); and to the steep ravines 12–15 km north of the bay, and 2–4 km above the edge of the flat coastal plain (nos. 20904–20956, November 9–10). These ravines, near where we had camped in 1959, supported a luxuriant forest of *Brosimum, Bursera,* and *Ficus* on a calcareous substratum, with *Orbignya* and *Hura* dropping out above about 350 m.[1]

On November 11 and 12 we made successive excursions to the hamlet of La Manzanilla on Tenacatita Bay, collecting nos. 20957–21024. From a road-junction about 3 km north of Bahía de Navidad, a primitive road crossed the mountains to La Manzanilla, ascending to about 200 m in the first 3 km and then descending a creek valley for about 5 km (crossing the creek 12 times) before leveling off in the coastal *Orbignya* forest for the last 5 km. The forest on the hilly part of the road included a large element of *Orbignya* throughout, and various deciduous trees as well.

Professor Rzedowski rejoined our party on the evening of November 11. On the 13th we explored the possibility of reaching Tomatlán via La Huerta, but found the road impassable. On the 13th, 14th, and 16th we collected on two hill-savannahs dominated by *Curatella* and *Byrsonima,* the one about 20 km south of La Huerta, the other between La Huerta and La Resolana (nos. 21037–21064, 21066–21126, 21396).

We moved our base to the Hotel Valencia in Autlán for the nights of the 15th and 16th of November, and the next day we drove again to Talpa, finding the country much drier everywhere than it was when we came through a little over a month ago. On the 18th we drove over the mountains to La Cuesta and attempted to go on to Llano Grande and Tomatlán, but found the road impassable, so returned and camped in the humid deciduous forest mixed with coffee plantations, 3 km above La Cuesta, at an elevation of about 800 m. On the 19th we collected around our camp and along the road above and below it (nos. 21129–21177). The next day we walked up a little higher (800–1100 m) and collected nos. 21178–21240, mostly in the high sub-deciduous forest, but partly in the oak forest on the ridges. On the 21st we took nos. 21242–21262 from the same general localities. On the 20th we had a heavy 3-hour rain in the evening. A young man who lived in La Cuesta, Sr. Wenceslao Avalos, visited us and spent a day with us, giving us many local vernacular names for plants. On the 21st Rzedowski and Feddema engaged a ride on a truck going to Llano Grande; they returned at 8 a.m. the next morning, having ridden all night; they had a few plants, which we numbered 21263–21275B.

We broke camp in the coffee plantation about noon on the 22nd, crossed the pass to the side facing Talpa, and camped in the pine forest above the stream, at an elevation of about 1350 m. On the way to this day's camp we collected nos. 21276–21310. We stayed and worked here until November 26, when we moved for one night to a locality on another branch of the Río Talpa, after which we returned through Talpa and turned eastward on the 27th. We collected nos. 21311–21434, and 21437–21438 at our first camp in the pine forest between Talpa and La Cuesta, mostly in the *barranca*-forest, November 23–25. Dr. Rzedowski left us on the 25th, to return to Mexico. On the 26th when we left camp, we crossed the Río Talpa, then turned right (east) at the first ranch (Los Sauces), taking a little-used road said to go eventually to San Miguel de la Sierra and Ayutla. We went in for about 5 km,

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[1]These forests near the highway were almost all destroyed by cutting and burning between 1960 and 1965.

ascending from about 1250 m at the ranch to 1400 m, finally camping in a deep forested stream-valley; here we collected nos. 21435–21436, and 21439–21472.

After passing through Talpa on the 27th, we drove out on the road to Los Volcanes as far as the junction with the road to La Mirandilla and El Rincón (i.e. ca 10 km east of the Talpa-Mascota junction). We passed El Rincón (the site of a large sawmill-village), 14–15 km south of the highway, and began to ascend a rapidly narrowing stream-valley. We camped at the 3rd water-crossing, in a forest dominated by *Fraxinus* and *Alnus,* about 6 km south of El Rincón, at an elevation of about 1600 m. On the 28th we collected near camp (nos. 21473–21503), then continued up the valley for 5 km, ascending to 1700 m at a road-junction where we turned abruptly right (west) up the mountainside and rose to 2100 m in 4 km.

We turned left and followed more or less along the summit of a high ridge and camped in a clearing left by loggers, about 2 km down the ridge, at about 2250 m. We found the next morning (November 29) that we were about 5 km from La Cumbre, another sawmill village well-known throughout the area. We followed the ridge all morning, travelling generally southward and south-eastward, with precipitous descents on our right. The forest on the ridge was mostly of pines, with firs (*Abies*) in the ravines on our left and ascending practically to the summit. Elevations along the ridge ranged from about 2100 to 2350 m. We continued through La Cumbre, then after another 12–14 km to the hamlet of El Carmen, and after about 12 km more we reached the sawmill village of San Miguel de la Sierra, where I had visited in 1952. We camped in the dry pine-oak forest 3 km east of San Miguel, and drove through to Guadalajara on the 30th.

Our collections after leaving the valley of El Rincón included nos. 21505–21549 in the fir forests north of La Cumbre, nos. 21550–21560 in the region of El Carmen, 21561–21573 from east of San Miguel de la Sierra.

1962

In company with Dr. Arthur Cronquist of the New York Botanical Garden, I arrived in Tepic October 3, after a short period of field work in Durango. Dr. Cronquist was especially interested in improving his knowledge of Mexican Compositae, and his collecting was concentrated in this family. In my collecting I made an attempt to specialize on the more interesting things I had not noted before in Nueva Galicia, with emphasis on the genus *Bursera.* We maintained separate series of collections. On October 4 we drove to Guadalajara, collecting nos. 21755–21763 near La Laguna beyond Santa María del Oro, and 21765–21774 on grassy summits west of Plan de Barrancas near the Nayarit line. On October 6 we drove to Querétaro, collecting nos. 21776–21782 at the crossing of the Río Lerma 11 km northwest of La Piedad.

We worked in eastern and southeastern Mexico until October 26, when we drove from near Ario de Rosales via La Huacana and Zicuiran to Apatzingán, where we stayed at Hotel Tapachula. On the 27th, after necessary repairs to the truck, we drove to Buenavista Tomatlán to inquire about a road north to Los Reyes, but were informed that no readily passable road existed, so we returned through Apatzingán and ascended into the pine forest below Uruapan, where we camped. On the 28th we continued through Uruapan to the junction with the road past Paricutín, where we turned left. A good gravel road took us some 60 km to Los Reyes, almost all the way through high pine-covered hills, until near Peribán de Ramos we began to descend. We collected nos. 21959–21965 near Los Reyes, then went on via Zamora to Jiquilpan.

On October 29 we drove to Colima, collecting nos. 21966–21979 at localities along the highway. The next day we attempted to drive to Atenquique via Tonila, a road I had passed over in the dry season in 1951, but we were informed that there was

now no passage between San Marcos and Atenquique, even for jeeps, so we returned to Colima and took the regular road to Atenquique via the cut-off below Tecalitlán. We continued around the Nevado de Colima to the north flank, where we camped at about 2200 m. On the 31st we drove around the north end of the volcano, mostly downhill through rich pine-oak forest for 12–13 km, then about 3 km through cornfields to Jazmín at 1600 m. West from Jazmín the road ran slightly downhill for 3 km to the junction of roads from Tolíman and Tonaya. We took the right fork (that to Tonaya), newly cut rather straight down a ridge to the northwest, avoiding the old road to San Gabriel. We passed Totolimispa (at 1100 m), some 12 km from Jazmín, and after another 12 km to the northwest we reached Apulco, when we began to follow a river toward Tonaya, which is about 10 km further along. Here we were directed toward El Limón, but eventually found that the usual road was impassable. After a series of back roads, mostly after dark, we failed to find El Limón but were sent to El Grullo, from which it was an easy trip to Autlán. During the day's travel we collected a few specimens, mostly in the thorn forest between Totolimispa and Tonaya (nos. 21980–21994).

On November 1 we drove out over the highway pass southwest of Autlán and I collected nos. 21995–21999, all species of *Bursera*. The following day we drove via Ayutla to a camp in the fir forest about 3 km beyond San Miguel de la Sierra. My collections for the day, all from between Ayutla and San Miguel, were nos. 22000–22016. On November 3 we collected near our camp (nos. 22017–22057), then drove on through the cut-over fir-forest, along the road toward El Carmen. About 7 km from our first camp, or 10 km from San Miguel, we stopped for the night in the pine forest, and the next morning I collected nos. 22058–22074. We left in the fog and rain soon after noon, and made our third camp about 5 km east of San Miguel, near where our party had stopped in November 1960. On this whole trip to San Miguel we were much hindered by rain, and on November 5 we collected only nos. 22075–22081, all the way back to Ayutla. We continued to Guadalajara, where we stayed at Motel Isabel through November 8, making short excursions to Juanacatlán and Ocotlán (November 7, nos. 22082–22090) and to the barranca below Huentitán (November 8, nos. 22091–22111).

We left Guadalajara on November 9 on the rough rocky road to San Cristóbal de la Barranca, and made camp at 5 p.m. under the cliffs some 6–7 km north of Milpillas; here at the beginning of the descent to San Cristóbal we found an interesting series of *Bursera* hybrids. Collections for the day were nos. 22112–22133. On the morning of the 10th we went down to San Cristóbal, crossed the river by a narrow rickety suspension bridge, climbed by a rough steep road to the Zacatecas line and continued over dry grassy hills to Mezquital del Oro, about 30 km from San Cristóbal. Here the road ended; it was impossible to cross to the highway in the Moyahua-Jalpa valley, so we started back to Guadalajara and camped in Jalisco at the head of the descent to the Río Santiago. On the 11th we returned to Guadalajara by the same road, and on the 12th we left for San Luis Potosí and Michigan. Our collections on November 10 and 11 included nos. 22134–22149, mostly from the broad *barranca* north and south of San Cristóbal.

1965

In January and early February, assisted by William R. Anderson, Chester W. Laskowski and Michael F. Baad, I collected in southern Mexico as far west as central Michoacán. We left Apatzingán on March 1 for a week's excursion to the Dos Aguas area, west of Aguililla in the high mountains, that I had visited briefly in September 1958. We camped that night at the lower edge of the oak zone at an elevation of

1200 m, some 8 km northwest of Aguililla and 22 km below Dos Aguas, where in a forested outcrop of jaggedly eroded and tumbled limestone we found many interesting species (nos. 22646–22670, 22673, 22875). On the 2nd we rode up to a base camp in the pine forest about 6 km below Dos Aguas, at about 2000 m. From this base we collected in the nearby forests (nos. 22671–22777, March 3–4), then worked along the lumber roads that followed the summits of the ridges, at elevations between 2200 and 2500 m, as far as El Barroloso, about 32 km southwest of Dos Aguas. On March 5th and 6th we collected nos. 22778–22856, mostly along these summit ridges. On the 7th we returned to Apatzingán, collecting nos. 22857–22874 in the deciduous forest along the road between Aguililla and the Río Tepalcatepec bridge.

On March 9–10, with Anderson and Laskowski, I made an excursion via Buenavista Tomatlán and Tepalcatepec to Jilotlán de los Dolores, the latter a small village in Jalisco but in the upper watershed of the Balsas-Tepalcatepec basin. The deciduous forest was very dry at this season but we collected nos. 22876–22919. We returned on the 10th to Motel Río Grande in Apatzingán; on the following day we drove out of the valley through Uruapan, thence to Jiquilpan and the south shore of Lake Chapala. About 15 km west of Tizapán el Alto we took the road up toward Concepción de Buenos Aires and camped on the high plateau near that place. Continuing through Concepción on March 12, we crossed the summit at about 2250 m in the pine forests west of the town, dropped down in a southerly direction to Ferrería de Matamoros (about 40 km from Concepción), and then in approximately the same direction to Tamazula, at the edge of the canefields at an elevation of about 1100 m. Our entire party spent the night at Motel Costeño, Colima. Our collections on March 12 included nos. 22922–22942.

On March 13 we camped near the pass in the gypsum hills 17–18 km south-southwest of Colima, collecting nos. 22943–22974. On the 14th we went by way of Tecomán and Cerro de Ortega, crossed the new bridge over the Río Coahuayana, and drove about 24 km from the bridge, through coconut plantations and lowland forests of *Orbignya* or of deciduous trees, to San Juan de Lima, where we camped on the uninhabited and undisturbed beach. Between Tecomán and San Juan we collected nos. 22975–22988, and on the following day near our camp and on the return to Coahuayana nos. 22989–23012. On that night (15th) we stayed at Hotel Playa de Santiago on Santiago Bay, where we learned that the road to Durazno, Jalisco (destroyed in the hurricane of 1959) was now passable but little used, as the timber was now being taken out to Guadalajara. On the 16th we collected along the highway in the deciduous forest between Santiago and La Huerta, camping just above the latter place (nos. 23013–23041A, and near camp on the 17th, nos. 23042–23052).

After reaching Autlán on the 17th, we planned an excursion across the high mountains to the southeast, the so-called Sierra de Manantlán, which Wilbur and I had reached from the north (from El Chante) in 1949, and which Sooby and I had entered from the south, via Santiago and the lumber camp of Durazno, in 1952. On March 18 we took the newly paved road to El Grullo, then turned southward over a very indirect series of roads to El Chante, which lies at the edge of the valley at an elevation of about 950 m. From El Chante we climbed in a southerly direction, passing a series of low summits and rough *barrancas,* finally camping about 20 km from Chante in a dense forested stream-valley, and ascending the next morning another 5 km to the summit of the ridge ("La Cumbre"), at the junction where the road began its descent to Durazno and Santiago. The elevation here was about 2000 m. We continued along the summit ridges to the eastward, establishing a camp about 5 km east of La Cumbre, and working out in both directions. The sawmills called San Miguel I, La Nevería, and El Cuartón, which I had seen in 1952 in the neighborhood of our present camp, had disappeared, and lumbering operations were being carried on some 15–20 km farther east. During our ascent, on March 18 and 19, we took nos.

23053–23094; during our stay on the summit, March 19–22, we collected nos. 23095–23176. About midday on the 22nd we returned to La Cumbre and began the descent down the almost unused road to Durazno, so steep that we went down in our lowest gear in 4-wheel drive to save the brakes. We camped in the pine forest about 2 km below the summit, on the exact spot where Sooby and I had stopped in November 1952. We were pleased to find *Matudaea* and *Podocarpus* in abundance in the ravines, exactly as in the forests around Talpa. On the way down to camp this day, and near camp the next morning, we collected nos. 23177–23215. On March 23 we broke camp about noon, and descended to a point about 8 km below La Cumbre, where we camped at about 1250 m, on a clear running stream in a humid deciduous forest. It transpired that we were almost at the foot of the declivity, 2.5 km above the site of Durazno, which was in 1952 a bustling sawmill town but was now reduced to a few miserable huts. Above and near our camp we collected nos. 23216–23251.

On the 24th we left at mid-morning, drove through the deciduous forests (now excessively dry) via Cuzalapa to the old river crossing of the Río Cihuatlán (where the bridge was destroyed in 1959), and camped after fording the stream. On the 25th we drove to Santiago and Autlán, sent a party to Guadalajara (now only a ride of 2 hours and three-quarters over the newly paved road), and prepared for another trip to Talpa. Collections on these last two days were nos. 23252–23262.

Leaving Autlán early on the 27th, we breakfasted in Corcovado Canyon while collecting nos. 23263–23272, then drove on into the dry pine forest past Cuautla and Los Volcanes, and camped near the summit where the road drops down precipitously into Talpa; along the road and near camp we took nos. 23273–23285. On March 28 we headed in the direction of La Cuesta, stopping briefly in Talpa to admire the town, which had been electrified since our visit in 1960. We camped the first night in the pine forest some 20 km south of Talpa, collected near camp and in the nearby barranca on the 29th and 30th (nos. 23286–23337). After leaving on the 30th, we crossed the divide toward La Cuesta and descended about 2.5 km through the subdeciduous forest to a camp on a small level area near water. We stayed here two nights, then on April 1 drove down to La Cuesta and returned, finally crossing the pass again and stopping for the night at our camp of March 28 and 29th. Our collections included nos. 23338–23411 from the La Cuesta side of the pass.

On April 2 we left the area, passed through Talpa and continued by way of Mirandilla and El Rincón, in an attempt to retrace the route I had followed in November 1960 to San Miguel de la Sierra. We followed the road past El Rincón to a camp in the valley, about 1 km beyond our camp of 1960, then the next day ascended to the summit north of the sawmill "La Cumbre" by a new road that branched off 1 km south of the old road (or from a point some 12 km south of El Rincón), and followed up a stream-valley for 4 km before coming out on the old lumber road north of La Cumbre. We found the narrow stream-valley heavily forested with *Abies, Podocarpus,* and the usual deciduous trees of the *barranca*-forest, and camped on April 3 about halfway to the top, at an elevation of 1900 m. On the 4th we continued over a much-improved road to El Carmen, San Miguel, Ayutla, and Autlán, and on the 5th to Guadalajara. Our collections after leaving Talpa included nos. 23425–23441, and 23469–23475 in the valley of Mirandilla and El Rincón (April 2–3), 23442–23468, and 23476–23482 in the ravines between the valley and La Cumbre (April 3–4), and 23483–23500 between El Carmen and San Miguel (April 4).

We stayed in Guadalajara through April 8, making excursions to Villa Corona on the 7th, in company with Sra. Luz María Villarreal de Puga and Sr. Dr. Enrique Estrada Faudón, to collect *Cirsium horridulum* from the saline marshes there (no. 23501), and to the Barranca de Huentitán on the following day to collect a few flowering trees (23502–23504). On the 9th Baad left for Ann Arbor with about half our collections in one vehicle, while with Anderson and Laskowski I set out for Tepic

and Mazatlán. We camped near El Ocotillo (one of the classic localities at which Josiah Gregg had collected in 1849), and in company with a local rancher who gave us many local vernacular names for plants, we collected nos. 23508–23535 in the oak forest on the morning of the 10th. On the way to Tepic we collected a few things (nos. 23535–23539) in the vicinity of Santa María del Oro. The next morning (April 11) we made a round trip to Jalcocotán and Miramar, then via Mecatán to the San Blas road and back to Tepic. We managed to collect nos. 23540–23582, but found the lowland forests very dry and decided to leave at once for home. We left Tepic on the morning of the 12th, and drove through rapidly to Mazatlán and Durango.

1967

After attending the meetings of the American Institute of Biological Sciences at College Station, Texas, I drove through Coahuila and Zacatecas, accompanied by my wife, Ruth B. McVaugh. On September 4 we came into the State of Aguascalientes from the north, via Rincón de Romos, where we turned left toward Asientos. We crossed the limestone mountains between Tepezalá and Asientos, about 20 km east of Rincón de Romos, and collected nos. 23644–23666 along this road; continuing over the mountains to Ciénega Grande, we drove by the paved road to Aguascalientes and made our base at Motel San Marcos. From this base we went out again to the Asientos-Tepezalá region on September 5, 6, and 7, collecting nos. 23667–23768, and on the last day climbing among igneous rocks to an elevation of about 2400 m on Cerro San Juan, south of the highway. We had been hampered by showers in the mountains, and on the 8th we had hard rains but managed to get nos. 23769–23791 along the highways north and northeast of Aguascalientes, and between rains near the road from Asientos to Ciénega Grande.

On the 9th we drove to Guadalajara, on paved road, passing many evidences of floods, via Calvillo, Jalpa, and the new bridge over the Río Grande de Santiago north of Guadalajara. Along the way this day we collected nos. 23792–23803. On the 10th we drove to San Juan Cozalá, whence on the 11th, with Sra. de Puga and a guide, I climbed a steep stairlike trail to the summit of the pass above Lake Chapala. We collected in the deciduous forest facing the lake, and in the oak forest north of the mountains (nos. 23804–23862). Sra. de Puga returned to Guadalajara; Mrs. McVaugh and I stayed in San Juan another night before joining her in that city. On the 13th, with Sra. de Puga, we drove back on the Zacatecas highway to some areas of pine forest and marshy meadows 12–15 km north of Ixtlahuacán del Río, where we collected nos. 23863–23884. On the 14th, with Ing. Luis Puga y Robles Gil and Sra. de Puga, and Biól. Juan Carlos Díaz Luna of the Autonomous University of Guadalajara, we drove to Tequila and ascended to an elevation of about 2800 m on the Cerro de Tequila. The road up the mountain had recently been paved with stone to permit access to a television station near the summit. We collected as we walked down through the oak forest, nos. 23885–23925. This ended our active collecting in Jalisco; we left Guadalajara on September 16, collecting only nos. 23926–23928 in marshy meadows near Atotonilco el Alto.

1970

Assisted by William L. Graham and W. D. Stevens, I collected for a few days in early November in Guanajuato, especially in the area around Santa Rosa where Humboldt and Bonpland had collected in 1803, and between the City of Guanajuato and Villalpando, where Méndez had collected for DeCandolle. On November 13 we

drove to León in western Guanajuato, and made our way southwestward along the border of Nueva Galicia, via San Francisco del Rincón and C. Manuel Doblado, collecting nos. 24268–24284 in the dry volcanic hills along the way. We turned westward just beyond Manuel Doblado, and passed over a very newly paved road through the mountains on the Jalisco-Guanajuato border. We camped here in the oak-pine forest about 35 km east of Arandas. The next day we collected nos. 24287–24355 near our campside, then in the afternoon drove up on the high grasslands between the mountains and Arandas, and collected nos. 24356–24385, mostly in muddy depressions at elevations of about 2200 m. On the 15th we took nos. 24387–24394 near our camp, then drove to a rocky stream-valley 3 km toward Arandas, where we collected nos. 24395–24422 before driving on to Motel Isabel in Guadalajara. Our collecting up to this point was hampered by the dryness and lateness of the season.

We made a few collections in the vicinity of Guadalajara (nos. 24423–24429, November 16–17), then left on the 18th for Ciudad Guzmán. We stopped briefly on the foothills of the Nevado de Colima, then drove back to C. Guzmán and on to Zapotiltic, Tecalitlán and the Sierra del Halo, camping late in the pine forest some 5 km from the highway, where we had collected first in 1957. On the 19th we made an excursion southwest of Pihuamo to the forested limestone areas I had explored with Koelz and Miranda in 1959, hoping in vain to find several critical species in flower before the effect of the dry season became too noticeable. We collected nos. 24437–24471, and 24496, then returned to our last night's camp in the cool pine forest and collected nos. 24472–24495. On the 20th we set off to cross the Sierra del Halo to Jilotlán, the road having been cut through and graded soon after our visit to Jilotlán in 1965. The well-traveled lumber road wound in a generally southerly direction for about 30–32 km from the Colima highway, ascending to an elevation of about 2100–2200 m, and maintaining this level for most of the second half of the distance, then from a summit overlooking the town of Pihuamo, dropping down to the old sawmill town of San Isidro (now apparently abandoned, as we did not see it), and after another 5–6 km descending to 2000 m at Plan de Lego, formerly a remote rancho and in 1970 a bustling sawmill village. Here we took a left fork and started more or less eastward, descending rather rapidly. We camped in the pine forest about 24 km from Plan de Lego (or, as it turned out, about the same distance west of Jilotlán), at about 1600 m, and collected nos. 24502–24562 that night and the next morning.

On the 21st we continued to descend in the same general direction, soon passing into a deciduous forest dominated by *Bursera* and *Pseudosmodingium,* where we collected nos. 24567–24587, then continued downward to a camp about 8 km west of Jilotlán. On the morning of the 22nd we took nos. 24588–24615 from the drying *Bursera-Lysiloma* forest, then continued through Jilotlán to a camp about 8 km further on, in a creek bottom surrounded by disturbed and overgrazed hills, at about 800 m. On the 23rd, as we continued by the regular road to Tepalcatepec, we collected along the road, and near camp, nos. 24618–24648. We spent the night in Apatzingán, and the next day (24th) drove up on the Dos Aguas road to our 1965 campsite about 6 km below the settlement. For the next few days we made general collections without going beyond Dos Aguas, partly in the pine forests near the settlement (nos. 24650–24690, 24721, 24765–24779), but especially in the deciduous woodlands covering extensive areas of sharply eroded and tumbled limestone rocks, at elevations between 1400 and 1700 m (nos. 24691–24720, 24722–24764). We returned to Apatzingán on November 27, and left the next day for the western foothills of Cerro Tancítaro. The stretch between Buenavista Tomatlán and Peribán de Ramos, which we had found impassable in 1962, was in 1970 provided with a good gravel road. We passed through the thorn forest, rose to the lower limit of pines at about 1100 m,

about 22 km from Buenavista, then camped in the foothills 12–14 km south of Peribán. We collected in the vicinity of our camp, and in the somewhat less disturbed pine forest 6–7 km south of Peribán (nos. 24787–24870, November 29), and drove on the 30th by a winding gravel road to the village of Apo, on the flank of Tancítaro at about 2200 m (nos. 24872–24898). Leaving camp the same day we drove through avocado orchards to Peribán, continued to Los Reyes, thence by paved road to Cotija, near the Jalisco border. About 3 km east of Cotija we took an unimproved road to the north, passing over cane-fields in a flat valley for 5–6 km, then climbing abruptly up an escarpment to the northeast for another 3–4 km and camping in the very dry *Bursera-Ipomoea* woodland at about 1800 m. On December 1 we collected nos. 24900–24933 near camp, then drove to Jiquilpan via Jaripo, and continued to Colima the next day.

From a base at Motel Costeño, Colima, we made an excursion (December 3) over the newly paved road to the Barranca de Beltrán, a famous collecting locality in the days of C. G. Pringle, but in recent years nearly inaccessible; here 12–15 km northeast of Tonila we took nos. 24939–24957. Because of the lateness of the season we decided to leave at once for the coast, so set up camp the night of the 3rd in the much-collected hills near the pass south-southwest of Colima; here from the gypsiferous soils we collected nos. 24958–24969. On the 4th we drove directly to the coast, where on the beach between Santiago and Manzanillo we established a base at Posada del Sol. We made a short excursion to the river by the old road to Durazno, but found the approaches to the ford completely washed out and the river consequently unreachable. On December 5 we collected in the lowland deciduous forest between Santiago and Cihuatlán (nos. 24980–25030), and on the 6th we drove to Bahía de Navidad and then over the new graded highway across the first range of mountains, 13–14 km to La Manzanilla, which we had reached in 1960 by a more difficult and devious way. In the coastal forest of *Orbignya*, and in the mixed forest on the hills above, we collected nos. 25031–25076. We understood that the good graded highway was finished all the way through to Puerto Vallarta, and we determined to pass over it, as botanical collections from this part of Jalisco were almost non-existent.

We were joined on December 7 by Sr. Alfredo Pérez Jiménez, a graduate student from Mexico City, who had consented to guide us through a tract of University-owned land, the so-called "Centro de Investigación y Experimentación de la UNAM," about 8 km east of Chamela on the old dry-weather road to La Huerta. Here we camped in the lowland deciduous forest of *Cordia, Thouinidium, Caesalpinia* and other trees, near the drying sandy bed of the Río Chamela, at an elevation of about 30–50 m, for 4 nights, collecting nos. 25077–25235.

On December 11 we returned to Chamela and took the Puerto Vallarta road through the sparingly inhabited lowlands toward Tomatlán. We camped in the deciduous forest in low hills about 50 km northwest of Chamela, after the road had swung inland away from the coast and about 25 km after we crossed the Río San Nicolás. Near the camp, and in other localities north of the river, we collected nos. 25240–25334.

We left this camp on December 13, then about 6 km further on came to the end of the improved road and had to continue 16 km to Tomatlán over the old unimproved road farther east. On the way we passed an area of upland thorn-forest where we collected nos. 25335–25349. We forded the broad but now shallow river at Tomatlán (elevation ca 50 m or less), passed regretfully without stopping through extensive areas of *Crescentia* savannahs (now dry), rejoined the graded road about 10 km (west?) of Tomatlán, and turned northwest toward the hills. After passing through extensive forests dominated by *Hura,* we began to see oaks (*Quercus magnoliifolia*) on the hills about 30–32 km beyond Tomatlán, and at about 40 km north of that place

(or, as it transpired, 11–13 km south and southwest of El Tuito), we camped in the valley of the Río Las Juntas at about 250–300 m in a tropical subdeciduous forest overhanging a rapid, rocky, mountain stream. Here on December 14, 15 and 16 we collected nos. 25355–25445, and 25456–25459. Later on the 16th we moved our camp to a very similar location in another river valley only about 16 km further north, i.e. about 5 km north of El Tuito, at an elevation of about 650 m. We took nos. 25460–25521 here, December 16–17, and moved on the 17th to Puerto Vallarta, where we made ready for a trip to San Sebastián and Mascota, via Ixtapa and Las Palmas.

Sr. Pérez left us on the 18th to return to México. The rest of the party made its way to Ixtapa, thence by a narrow unimproved road to Las Palmas, a fair-sized village on the Río de Ameca almost due north of Puerto Vallarta. Here we found that wheeled traffic was stopped; the dry-weather road to San Sebastián, barely passable at best, had not been repaired after last fall's rainy season, and nothing was going over it. We managed to go on for 3 km, and camped by a good running mountain stream in the *Hura-Brosimum* forest at 150 m elevation. Our collections were nos. 25525–25534 and 25587–25588, between Ixtapa and Las Palmas, and nos. 25535–25582, and 25685, near our camp on Arroyo de Las Palmas. We left camp on December 20, drove for the first time for any of us over the new paved road north to Las Varas and Compostela, and continued to Tepic. The new road from Las Varas to Compostela by-passes Mazatán, but cuts through some interesting oak-savannah country where we hastily collected nos. 25583–25586, and 25686, at an elevation of about 200 m.

We left Tepic early on the 21st, passed as quickly as possible through Guadalajara, and left at once for our last excursion of the year, to the mountains of the southern arm of Zacatecas, between Jalpa and Tlaltenango. We camped in a pasture about 4 km north of Moyahua, and continued the next day to Jalpa, where we found we had to retrace our steps about 10 km to the junction of the road that leads over the mountain. From an elevation of about 1300 m at the highway, the road led generally westward, up through the dry deciduous woodland over a series of successively higher ridges; the first plateau was about 8 km from the highway, at 2000 m. A few oaks appeared near here; high above and ahead could be seen a high rocky plateau summit with a dark forest cover. At about 15–16 km from the highway the oaks increased in numbers, and the arborescent Ipomoeas disappeared. At about 20 km from the highway the road ascended some very steep bluffs and came out on a series of level grassy oak-studded benches at about 2400 m. We camped here for one night, collecting here and in the more sheltered oak-pine forest a little higher up (nos. 25589–25593, 25595–25658, 25687). On the 23rd we descended into the *Ipomoea-Ptelea-Dodonaea* woodland to an elevation of about 2000 m., where we camped for the night. Along the road and near our camp we collected nos. 25659–25683, and 25594. We returned to Guadalajara on December 24, and ended the field-season there.

McVaugh, Ruth Beall. See McVaugh, Rogers (1967).

Madrigal Sánchez, Xavier. Biól. Madrigal, of the Instituto Nacional de Investigaciones Forestales, México, collected the type of *Pinus rzedowskii* in the mountains near Dos Aguas (cf. Bol. Téc. Inst. Nac. Invest. For. Méx. 26: 8. 1969). His collections also include a series made July 5–10, 1969 (at least nos. 2258–2310), from the Volcán de Colima, Unión de Tula, Volcán de Ceboruco, and Volcán de Tequila.

Maltby, T. S. The United States National Herbarium (US) has a series of about 40 specimens (nos. 1–40) collected by T. S. Maltby at San Blas in April 1897. His entire collection of this year (about 247 specimens) was received by the National Herbarium in 1898, as a gift from Professor C. L. Herrick of the University of New Mexico. Most of the specimens bearing numbers 45 and above were collected on María

Madre Island, which Maltby, in company with E. W. Nelson, E. A. Goldman, Professor Herrick and the latter's son, visited in May of this year.[1] The party left San Blas in a sailing vessel on April 28, reached María Madre on May 2, worked nearly a month on the Tres Marías, and returned to San Blas June 1. Nelson (loc. cit.) states that while he, with Goldman, was arranging for a boat to make the trip to the islands, Herrick's party "arrived at San Blas, also bound for the Tres Marías." Maltby collected at San Blas for a few days only, while awaiting passage to the islands. On some specimens in the National Herbarium his name is given as F. S. Maltby, and it is accordingly often published in this way. I have not been able to secure any biographical data on Maltby, and am not sure which initial is correct.

Manning, Wayne Eyer. In 1953, accompanied by his wife, Professor Manning of Bucknell University travelled in Mexico in connection with his revisionary studies of the American Juglandaceae. About 1500 numbered collections were made; many of these can be found in the National Herbarium (US) or the Gray Herbarium (GH). Several collections came from Jalisco, especially from along the highway between Lagos and Guadalajara. The specimens were distributed under the names of Manning and Manning, with serial numbers prefaced by 53, e.g. 531235.

Martínez, Maximino (1888–1964). In Professor Martínez' numerous papers on the Mexican flora, particularly those in the *Anales del Instituto de Biología* which have to do with the gymnosperms and oaks of Mexico, he recorded from Jalisco and contiguous areas several serially numbered specimens to which his own name is attached. These include the type-specimens of *Pinus michoacana* var. *cornuta* and its forma *nayaritana, Juniperus jaliscana, Abies guatemalensis* var. *jaliscana,* and *Casimiroa sapota* forma *jaliscana.*

Collections bearing Martínez' numbers have been cited from various localities, with the dates of collection ranging from May, 1937 to August, 1951, and with numbers from C20 to 28500. The following have been noted: Atengo, Jal. (2207, August 1951); Autlán, Jal. (407, August 1940); C. Guzmán, Jal. (87A, April 1939); Compostela, Nay. (3447, May 1941); Cuale, Jal. (7002, March 1944; 28000, 28500, November 1947); Pihuamo, Jal. (64B, May 1939; 342, April 1939); Poncitlán, Jal. (167, April 1939); Sierra de Nochistlán, Zac. (409, July 1940); Tecalitlán, Jal. (s.n., February 1939; 137, May 1937); Tecolotlán, Jal. (64, May 1939; 411, September 1940; 2208, August 1951; 3446, October 1941); Tequila, Jal. (64, May 1939; 74, July 1939; 3446, October 1941); Zapotlanejo, Jal. (C20, September 1939).

Professor Martínez informed me, however, that except for a trip to Guadalajara in 1949, he did not himself visit Nueva Galicia. The earlier collections which bear his name and numbers were obtained for him by other persons and his own numbers were subsequently assigned to the specimens for ease of citation and reference.

In September, 1949, while preparing his papers on *Taxodium* and *Casimiroa,* he made a trip by bus to Jalisco, particularly to observe *Casimiroa watsoni* at its type-locality in the *barranca* near Guadalajara, and to obtain distribution records of *Taxodium.* From Guadalajara he visited some nearby localities including Zapotlanejo and Chapala. His collections included about fifty miscellaneous specimens, which are deposited at the Instituto de Biología (MEXU).

Melchert, Thomas E. In connection with cytotaxonomic studies of *Bidens* and related genera, Professor Melchert of the State University of Iowa has travelled widely in Mexico since 1965. In 1966 he collected at various localities in Nueva Galicia, including the type-locality of *Cosmos sessilis* (cf. Sida 3: 175. 1967). Melchert's specimens are in the herbarium at Iowa (IA).

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[1] North Amer. Fauna 14: 8. 1899.

Mell, Clayton Dissinger (1875–1945). Mell, well known to botanists for his work on the timbers of tropical America, collected at San Blas in April and September, 1930. The specimens are in the United States National Herbarium (US).

Méndez, [Juan?]. See Alamán.

Mexia, Ynez (1870–1938). Probably the best-known plant collector of her sex who has worked in tropical America, Mrs. Mexia wrote in 1929 a little paper on her recent Mexican trip: "In 1926 I enthusiastically planned a botanical collecting trip to the western states of Mexico with the idea of exploring the more remote districts where I felt sure collectors had not penetrated and where I hoped to secure interesting and possibly new plants. . . ."[1] Her hopes were more than realized.

After a few profitable weeks around Tepic, and a little more than a month spent in Sinaloa and the coastal plain of Nayarit, she took a steamer to Puerto Vallarta, the northernmost port of Jalisco, and spent four months (November to March), exploring the coastal hills and in the mountains, travelling with pack animals, as far as San Sebastián where Nelson had collected 30 years before. Mrs. Mexia amassed a collection of more than 800 numbers in western Jalisco at this time; she obtained numerous duplicates, which were distributed by the University of California (UC). Numerous species new to science have been described from her specimens, and many species are known from western Mexico from her collections only.

An itinerary of the entire trip of 1926–1927 was published in her paper referred to above (pp. 237–238). The following summary of plants collected during her travels in Jalisco and southern Nayarit has been prepared from data supplied by Mrs. N. Floy Bracelin.

Tepic and vicinity, 9–20 September (nos. 500–727); Ixtlán del Río and vicinity, 23 September–2 October (728–908); [Sinaloa, 2–16 October (909–970)]; [lowlands of northern Nayarit, 22 October–8 November (971–1088]; [Mazatlán, Sin., 11–19 November (1089–1099)]; Puerto Vallarta, Jal., and vicinity, 23–28 November (1100–1168); Quimixto and vicinity, 29 November–2 December (1169–1219, 1230–1245); Puerto Vallarta and vicinity, 8–17 December (1246–1314); Puerto Vallarta to San Sebastián, 29–31 December (1315–1323); San Sebastián and vicinity, 1–25 January (1324–1575); San Sebastián to Real Alto, ?28 January (1576–1577); Real Alto and La Bufa, 29 January–2 February (1578–1629); Real Alto to San Sebastián, 3–4 February (1630–1642); San Sebastián, 8–13 February (1643–1673); Hacienda del Ototal, 14–16 February (1674–1699); trail to San Sebastián and Real Alto, 16–18 February (1700–1707); Real Alto and vicinity, 19–26 February (1708–1768); Real Alto to San Sebastián, 27 February (1769–1775); San Sebastián to Hacienda del Ototal, 2 March (1776–1786); Hacienda del Ototal and vicinity, 3–9 March (1787–1853); El Ototal to San Sebastián, 10 March (1856–1860a); Las Mesitas and vicinity, 14–17 March (1860b–1900); San Sebastián, 20–23 March (1901–1914); San Sebastián to Los Reyes and to San José del Conde, Nayarit, 25–29 March (1915–1933); [Sinaloa and Sonora, April (1933a–1945)].

For a notice of Mrs. Mexia's life and work see Madroño 4: 273–275. 1938. Twenty-two new species from her Jaliscan collections were described in a paper by Standley (Field Mus. Publ. Bot. 4: 197–299. 1929).

Meyer, Eliane. See Norman.

Mickel, John Thomas. See McVaugh (1957).

Miranda, Faustino (1905–1964). See McVaugh (1959).

Mociño, José Mariano. (1757–1820). See Sessé. The date of Mociño's death has often been given as 1819, but Rickett (cf Chron. Bot. 11: 78–79. 1947) examined a copy of the burial certificate indicating that he was buried in Barcelona on May 19, 1820. This agrees with the information in a letter from Lagasca to De Candolle, dated

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[1]Botanical Trails in Old Mexico.–The lure of the unknown. Madroño 1: 227–240. 1929.

at Madrid "Kal. Novembris MDCCCXX," in which he says Mociño died six months ago ["Mociño noster sex abhinc mensibus é vita discessit in urbe Barcinonensi. . ."].

Moldenke, Andrew R. Professionally an entomologist, Moldenke collected numerous plant-specimens on a trip through Nueva Galicia in 1967. A partial set is at the University of Michigan (MICH).

Molseed, Elwood (1938–1967). Collected in Mexico, including Nueva Galicia, in the summer of 1966 (cf Univ. California Publ. Bot. 54: vii, et seq. 1970). His specimens are at the University of California (UC).

Moore, Harold Emery, Jr. Working for a part of the time with Hugh Cutler (q.v.), Moore collected for a few days in 1940 (October 19–24), in the vicinity of Ciudad Guzmán. His collections were nos. 145–184.

With Carroll E. Wood, Jr., Moore travelled widely in Mexico in 1948. The two investigators visited Jalisco briefly, in search of certain species of *Tephrosia.* They traveled by automobile from Lagos de Moreno to Guadalajara and Tequila. Their collections were as follows, according to data furnished by Dr. Moore: Between Lagos de Moreno and Agua del Obispo, 30 August (no. 4817); Barranca de Oblatos, 31 August (4818–4824); along highway 4–5 km beyond Tequila, 31 August (4825–4833); between Amatitlán and Arenal, 31 August (4834–4836).

In 1952 Moore worked for some weeks in tropical America, carrying out investigations on the taxonomy of the palms. He passed through Jalisco on May 26, while on his way north by the west-coast highway, and made three collections of palms (nos. 6403–6405), the first in Jalisco near the border of Nayarit, the second near km 930 beyond Tepic, and the third near San Blas. Of Moore's more recent trips to Nueva Galicia I have no records.

Moran, Reid. Usually searching for specific Crassulaceae, or for Crassulaceae in general, Moran has visited Nueva Galicia several times since 1957. On his first visit, March 1, 1957, he collected nos. 5707–5714 at Carmen, Sierra de los Tejones, Colima, a locality to which he accompanied a geologist to inspect a tungsten prospect. On November 21, 1962, he passed through northern Jalisco, collecting nos. 10000–10002 at the pass [Paso de la Troje] 6 km west of Presa de Valerio. In 1968 he collected nos. 14704–14707 near Etzatlán (January 15), 14708–14719 in the *barrancas* below Guadalajara (January 16), 14720–14724 near the pass southwest of Autlán (January 17), and on the same day 14725 near Juchitlán and 14726 near Tecolotlán. Two weeks later (January 31) he collected no. 14796 north of Barranca del Oro, Nayarit. Moran's collections are in the Natural History Museum, San Diego, California (SD).

Morrison, John L. See California, University of.

Muller, Cornelius Herman. While engaged in field studies of the genus *Quercus,* Professor Muller of the University of California at Santa Barbara travelled widely in Mexico during the autumn months of 1951. His collections in Nueva Galicia were made near the principal highways, as follows: Refugio, foot of Cerro Sangangüey, east of Tepic, 18 September (nos. 9054–9057); east of Magdalena (at km 750), 18 September (9058 -9060); between Lagos de Moreno and Encarnación de Díaz, 31 October (9257–9259); Puerto de Trojes, 36 km west of Ojuelos, 2 November (9271–9275); between Lagos de Moreno and Ojuelos, 4 November (9295–9296). Muller's collections are in his private herbarium, housed at Santa Barbara, California, and duplicates have been distributed.

Among the Mexican oaks studied by Muller there are a few specimens from Nueva Galicia collected by each of the following: Messrs. Arroyo F., Córdoba M., Guzmán H., Pérez C., and Reyes Parra. I know nothing of the circumstances under which the collections were made.

Murrill, William Alphonso (1869–1957). Murrill, at that time Assistant Director of the New York Botanical Garden, spent the latter part of December 1909, and the first half of January, 1910, with his wife, Edna L. Murrill, in southern Mexico, studying and collecting the fungi of that region.[1] After spending some days near Cuernavaca, Morelos, the Murrills came by rail to the State of Colima early in January, 1910. According to the published statement cited above, collections were made in "Dense jungle along Armerica [Armería] River, near Tecoman, 200–500 feet, January 2, 1910," and in "Orchards and barrancas in and near Colima, 1600 feet, January 3–4, 1910." After this no further collections were made in western Mexico; the next collecting-station was near Orizaba, January 10–14. More than 100 collections of fungi were obtained by the Murrills in Colima (nos. 576–684, approximately). They collected some flowering plants also, including the type of *Selinicereus murrillii* Britt. & Rose, from Colima.

Nápoles, Maria de la Luz. Specimens of the genus *Quercus* from the State of Colima bear the name of this collector (ENCB 772, the Herbarium of the Escuela Nacional de Ciencias Biológicas, México).

Navarro, J. L. Collected at Cerro de García, Tuxcueca, August 2, 1951, according to Martínez in An. Inst. Biol. [Méx.] 24: 241. 1954.

Nelson, Edward William (1855–1934). E. W. Nelson and E. A. Goldman (1873–1946), working under the auspices of the United States Department of Agriculture, collected many plants as well as the animals with which they were primarily concerned. A detailed account of their fourteen years' association in the field was published by Goldman.[2] Their first field work was in 1892, in Colima and Jalisco (February to June). A full itinerary, and descriptions of localities visited, may be found in Goldman's book (pp. 3, 135–136, 169–183), which includes many notes on individual plants and on vegetational zones. As far as I have learned, no plants were collected in 1892. In 1896 one week (June 23–30) was spent at Lagos, Jalisco, and Nelson collected a few plants (his numbers 3881–3884, June 29); the next week (July 1–7) the party passed at Chicalote, Aguascalientes. In the following year, 1897, important collections of plants were made.

The field season of 1897 began for Nelson and Goldman in Ameca, Jalisco, where Goldman arrived on February 5 and was joined by Nelson on February 21. On March 3 they began a pack-trip to Tepic, through the mountains of western Jalisco and southern Nayarit, and on the same day Nelson began to collect plants, numbering the collections serially beginning with 4000.[3] In the course of the trip to Tepic he obtained 179 numbers, including the first series ever obtained from the mountains of western Jalisco. A large proportion of the species were new to science. Of 22 collections obtained near Talpa, Jalisco, for example, 12 have been reported in the literature in various places, and of these 8 were described as new.

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[1]Bull. N.Y. Bot. Gard. 7: 287. 1911; op. cit. 8: 137–153. 1912. On page 137 of the latter paper is given a list of "Localities and dates of the author's collections." See also a series of papers in *Mycologia,* beginning in 1911 with volume 3, entitled *The Agaricaceae of tropical North America.*

[2]Goldman, Edward Alphonso. Biological Investigations in Mexico. Smithson. Misc. Coll. 115: i–xiii, 1–476. frontisp., *pl. 1–70.* 1951.

[3]I have never seen any explanation of the fact that Nelson and Goldman apparently did not make joint collections of plants. Although both made extensive botanical collections over the years, they maintained individual number series. It may have been that one or the other would assume responsibility for botanical collections on a given trip. In 1897, at any rate, all the plants collected were credited to Nelson. In the present paper the data on the plant-collections of Nelson have been taken from his fieldbooks, on deposit in the United States National Herbarium (US), where the original set of his plants may also be found.

The itinerary between Ameca and Tepic, with descriptions of the individual localities, is given in full by Goldman, *op. cit.* (pp. 15–16, 169–182, 201–205) and need not be repeated here. Nelson collected plants at the following localities: Valley of Ameca, March 3 (nos. 4000–4002), near Huachinango, March 4 (4003 4012), Atenguillo to Jacala, March 5 (4013–4018), near Talpa, March 7 (4019–4041), Talpa to Mascota, March 13 (4042–4047), Mascota to San Sebastián, March 14 (4048–4068), San Sebastián and vicinity, March 16 (4069–4090), San Sebastián to Bufa de Mascota, March 20 (4091–4115), La Laguna, Sierra de Juanacatlán, March 25 (4116–4119), San Sebastián, March 27 (4120), San Sebastián to Las Palmas, March 30 (4121–4133), Las Palmas to Ixtapa, March 31 (4134–4137), Ixtapa, April 2–3 (4138 -4152), Valle de Banderas, Nay., to Colomo, Nay., April 4 (4153–4157), Colomo to Arroyo Juan Sánchez, April 6 (4158–4168), Compostela, April 7–8 (4169–4173), near Tepic, April 9 (4174–4175), Tepic to Navarrete, April 15 (4176–4178).

After a month's sojourn on the Tres Marías Islands, the two biologists returned to the mainland at San Blas, and on June 6 Nelson collected here, nos. 4334–4356. Soon after this they turned northward, into the low coastal plain of Nayarit and Sinaloa. J. N. Rose, of the U.S. National Herbarium, had been collecting plants in Sonora, Sinaloa and northern Nayarit since early in June, and on August 2 set out from Acaponeta, Nayarit, with Nelson and Goldman, to cross the Sierra de Nayarit. Complete itinerary and descriptions of localities are given by Goldman (*op. cit.* 16–17, 200–205, 144, 287–289, 170–180). Apparently all the plants on this trip were collected by Rose (q.v.), who in about six weeks of hard travel amassed a remarkable collection of approximately 1550 numbers in one to seven sets.

Nelson and Goldman returned to Jalisco in December, 1902, at which time they spent two weeks (December 23, 1902–January 7, 1903) at Ocotlán, and three days (January 7–10) at La Barca. A second visit was made to the same places, June 24–30, 1903. Goldman returned to this area near the eastern end of Lake Chapala, in connection with winter investigations of migratory waterfowl in Mexico, in 1926, 1935, and 1936. Here were formerly the largest and most important fresh-water marshes in Mexico, but much of the land has since been reclaimed for agricultural use (Goldman, *op. cit.*, pp. 172–178).

Plants were collected in 1902 and 1903 by Nelson as follows: Ocotlán, December 25–31, 1902 (nos. 6515–6521); Ocotlán, December 30 (6522); south slope of hills fronting Lake Chapala, [Jalisco], January 5, 1903 (6523–6532); Zamora, Michoacán, January 12 (6533–6540); La Barca, Jalisco, and Zamora (6541); Zamora, January 24 (6542–6548); Lake Chapala, Jalisco, June 26 (7081–7082). Leaving Zamora on January 27, 1903, the two investigators spent the next 5 weeks (until March 3) exploring the north slope of Cerro Patamban (where Nelson collected nos. 6549–6599), the vicinity of Los Reyes (nos. 6834–6844, 6847–6856, 6858–6873), and Cerro de Tancítaro, which they ascended from the northwest slope (nos. 6874–6908). Nos. 6845, 6846, 6857 came from near Tingüindín, February 5.

Norman, Eliane (Meyer). Mrs. Norman (then Eliane Meyer) travelled in Mexico in 1959, primarily to collect material for a revision of the genus *Buddleia.* She made some general collections near Ixtlahuacán de los Membrillos, in the hills north of Lake Chapala. Her specimens were distributed from the Bailey Hortorium (BH); some duplicates are at the University of Michigan (MICH).

Norris, Daniel Howard. A bryologist with a strong interest in the Mexican flora, Norris in 1970 made a 6-day excursion westward from Jesús María to the Sierra del Nayarit, accompanied by his student Daniel J. Taranto and guided by a Cora Indian, Victor Molina A. The following is adapted from notes supplied by Prof. Norris: "The trip basically followed the ridge between the river flowing from Mesa Nayar and the river from Santa Teresa. This brought us along a step-by-step series of mesa-like lava deposits, almost directly westward to a peak in the Sierra del Nayarit, which the guide said was almost due south of Santa Teresa and west of Mesa Nayar. He called the peak 'La Ciénaga.' I believe this is the 2800 meter point indicated on some maps."

On July 27 Norris flew to Jesús María, and collected nos. 13928–13994 along the river nearby, mainly in disturbed thorn-forest with cacti and *Bursera.* On the 28th he

collected along the trail to the mountains for a distance estimated at 15 miles, and camped in the first oak forest near a small settlement called Labra (nos. 13995–14172). On July 29 he collected nos. 14173–14248, along the trail through oak forest and grassy openings with *Acacia*, camping about 4 miles from the peak, in open, little-disturbed oak-pine forest near a place called Tepetate. On July 30 he collected in the oak-*Arbutus* forest and the grassy meadows near the summit of the peak (nos. 14249–14380), and on the 31st he continued near the peak, mostly in the deeper ravines and in oak forest on the steeper bluffs (nos. 14381–14652. He returned on August 1 to a small village called Cangrejo near Mesa Nayar, where he collected nos. 14653–14744 in open oak-pine forest and in a steep moist ravine near a waterfall. On August 2 he returned to Jesús María without collecting, and the next day returned to Tepic.

The specimens from this trip included 426 gatherings ("numbers") of vascular plants and about 390 of bryophytes. The latter are deposited in the herbarium of Humboldt State College, Arcata, California (HSC), and the largest set of vascular plants is at the University of Michigan (MICH). As far as I know this is the largest collection ever made in the Sierra del Nayarit.

Ogden, Eugene C. See Gentry.

Oliva, Juan (–). The son of Leonardo Oliva, q.v. He followed his father as a professor at the University of Guadalajara, and became known for his work in Botany, Chemistry, and especially in Mineralogy. According to Castañeda[1] his collection of monographs on the plants of Jalisco was lost after his death. According to Padre Severo Díaz,[2] Don Juan Oliva, just before his death, packed all his specimens and entrusted them to one of his sons with instructions to forward them to the Smithsonian Institution. At least a few of his plant-specimens, with numbers as high as 97, are to be found in the U.S. National Herbarium, and have been cited in literature.[3] The library of Juan Oliva, together with his herbarium, was preserved in Guadalajara, where in 1952 I saw it through the kindness of Sres. Alberto Lancaster-Jones and Ricardo Lancaster-Jones. The herbarium contained little or nothing from Jalisco, and apparently nothing collected by Don Juan Oliva or his father.

Oliva, Leonardo (1805–1873).[4] A native of Guadalajara, Oliva was internationally known for his work in pharmacology and botany. His two-volume "Lecciones de Farmacología" (1853–1854) is a classic. His posthumous "Florula" of Jalisco[5] consists of a list of species arranged by botanical families, with Spanish and Latin names and occasional comments on uses. Oliva was also the author of several other botanical papers published in the first part of *La Naturaleza* (1870). He maintained a personal herbarium but its whereabouts is unknown. The only significant number of his collections known to exist are at Paris (P), where they have come from several private herbaria, including those of O. Debeaux, Eugène Fournier, and Schultz Bipontinus. I have seen at Paris about 25 specimens from Oliva's herbarium, most of them Compositae, all undated, some unnumbered, others with collection-numbers as high as 52. Presumably the total number of Oliva's specimens at Paris is 100 or more. The

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[1]La Flora del Estado de Jalisco. p. 116. 1933.

[2]La tradición científica de Guadalajara. Bol. Junta Aux. Jal. Soc. Mex. Geog. y Est. 8 (No. 6): 271. 1945.

[3]Contr. U.S. Nat. Herb. 28: 292. 1929.

[4]These are the dates cited by Castañeda. According to the data accompanying a portrait of Oliva in the Museo Regional de Guadalajara, Don Leonardo was born 4 November 1814, and died 6 November 1872.

[5]Florula del departamento de Jalisco escrita en el año de 1859, por el Sr. Dr. Leonardo Oliva y comunicada á esta sociedad, por el Sr. Dr. Alfredo Dugés. La Naturaleza 1 (5): 88–99, 127–133. 1882.

localities noted on the labels are mostly near Guadalajara, a few on the way to Magdalena, Ahualulco, and the Barranca de Nochitiltic.

A few of Oliva's collections, dating from 1854 or 1855, were cited by Hemsley in the *Biologia Centrali-Americana* (e.g. *Gymnolomia squarrosa, Montanoa olivae* and *M. pyramidata*). The genus *Olivaea* and *Montanoa olivae* of the Compositae were named for Don Leonardo Oliva by Schultz Bipontinus.

Biographical notes on Oliva, together with a short sketch of the development of botany in Jalisco, may be found in Dr. Castañeda's flora, pp. 114–119.[1]

Orcutt, Charles Russell (1864–1929). Orcutt, a naturalist and collector, travelled in Mexico in 1910 and gathered numerous herbarium specimens, especially along railroad routes. He is known to have made the following collections in Colima and Jalisco, according to data sent to the Gray Herbarium in 1939 by Mr. Frank F. Gander: Tecomán, Colima, October 29 (nos. 4444–4455); Manzanillo, Colima, October 21 (4456–4505); Colima, Colima, October 24 (4506–4622); Alzada, Colima, November 4 (4623–4689); Tuxpan, Jalisco, November 4 (4690–4711).

A partial set of Orcutt's plants is at the Gray Herbarium (GH). His material has not been carefully studied, and has been little noted in the literature.

Painter, J. H. See Rose (1903).

Palmer, Edward (1831–1911). The first large series of botanical specimens ever to come from Jalisco was obtained in 1886 by Dr. Edward Palmer, then already well established as a professional collector. He made his headquarters in Guadalajara for nearly six months (June 1 to about November 25), and his collections of botanical materials included approximately 675 species of which about one-sixth were new to science. The plants were enumerated and described by Sereno Watson (and collaborators).[2] A few of Palmer's plants came from Tequila, where he spent some days in late August and early September, and a few were taken in and near Chapala in October and November, but the bulk of the collection came from within a radius of 15 or 20 kilometers from Guadalajara. Probably a majority of all the specimens were obtained within the walls of the *barrancas* of the Río Grande de Santiago, which were readily accessible no more than an hour's walk from the city. More than half the species, according to Watson's account, came from Río Blanco, a locality about 15 kilometers northwest of Guadalajara, in Palmer's time the site of a cotton mill. Here a clear rapid stream falls abruptly into the head of one of the *barrancas* and vegetation even in recent years is lush and relatively undisturbed. One or two kilometers to the north and northeast lies the Sierra de San Estéban, later a favorite collecting ground of Pringle and others. Palmer spent about a month in all at this locality, probably lodging at the mill and descending daily into the *barranca*; his principal visits were four in number (June 3–10, July 1–8, September 17–23, October 12–20).

Palmer also spent a week (June 16–23) as a guest at the Hacienda of Sr. Juan Nepamuceno Portillo, in the Barranca de Ibarra, northeast of the city and not far below the junction of the Río Verde with the Río Santiago. Here he obtained collections of about 70 species.

The remainder of his collections, approximately 200 species, are labelled only as from Guadalajara, and came doubtless from the plains and low hills near the city. For a map of this area, and a brief discussion of botanical work there, see *The Barranca of Guadalajara and its place in botanical literature.*[3] Palmer's plant-specimens included

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[1]Castañeda, Alfonso Manuel. La Flora del Estado de Jalisco. Bol. Junta Aux. Jal. Soc. Mex. Geog. & Est. 3: 113–160. 1933; also published as a separate, without change of pagination, Guadalajara, 1933.

[2]Proc. Amer. Acad. 22: 396–465. 1887.

[3]Asa Gray Bull. II, 1: 385–390. 1953.

approximately 770 numbers; they were divided into 14 major sets and 5 smaller sets, and these were distributed in the United States and Europe, with the first set to the Gray Herbarium (GH).

Four years later Palmer returned to this part of Mexico, this time as a collector in the employ of the United States Department of Agriculture. He spent nearly four months in the State of Colima, collecting at Manzanillo during December, 1890, and again March 2–18, 1891. The interim he collected in the neighborhood of the city of Colima from about January 9 to March 1, except for a ten-day period (February 6–15) which he took for a trip to Armería, Colima. The entire collection from the State of Colima, comprising nos. 886–1410, was reported upon by J. N. Rose in a long and thoughtful paper.[1] Rose (with the aid of various collaborators) described numerous new species from Colima (29 from Manzanillo, 26 from Colima [city], and 4 from Armería). In addition his list contained many species not previously reported from Mexico. This was actually the first large series of plants obtained from this part of the Mexican coast (although Barclay, Sinclair, and others had collected at Manzanillo years earlier), and Palmer's collection remains the most important contribution which has been made to our knowledge of the flora of Colima. The plants themselves were apparently distributed in about twelve sets, of which the largest (525 sheets approximately) is now in the U.S. National Herbarium (US).

After a brief period in Sinaloa and Sonora in 1891, Palmer arrived in Tepic soon after the first of January, 1892, and spent the first two months of that year visiting and collecting at the classical localities where botanists of the "Blossom" had worked 65 years before. He spent most of his time near Tepic, but visited Jalisco and Compostela. The specimens resulting from this collection (nos. 1813–2040) were distributed in many sets, but no report on them was ever published. The first set, that at the U.S. National Herbarium, included approximately 628 numbers, and there were at least ten other sets numbering from 107 to 585 specimens each.

Palmer's last visit to Nueva Galicia was in 1897, when he spent two months in the summer (approximately June 20 to August 19) at the city of Colima, collecting herbarium specimens and accumulating data, for the Department of Agriculture, on timber trees. I cannot find that he ever completed any report on his timber tree project, but apparently it took up a considerable share of his time, for his collections of dried plants included no more than 176 numbers. Few duplicate sets were collected; the first set is in the U.S. National Herbarium.

Much of the above information on Palmer was obtained from official records and from correspondence files and other unpublished sources. Nearly complete sets of Palmer's field-notes are available in Washington for the years after 1886.[2]

Paray, Ladislao. Paray, a botanist of Mexico City, formed a large herbarium which is now part of the collection at the Escuela Nacional de Ciencias Biológicas (ENCB). In 1958 he visited Nayarit and made a collection of about 50 numbers in his series 2674–2722, mostly on Cerro Sangangüey but also in some other localities near Tepic.

Paxson, John B. See Rowell.

Pennell, Francis Whittier (1886–1952). Pennell undertook long field-trips into Mexico in 1934 and 1935, primarily to collect material toward a revision of the Scrophulariaceae. In 1935 he spent 8 days in the highlands of southern Nayarit and adjacent Jalisco. The principal set of his collections is at the Academy of Natural

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[1]Contr. U.S. Nat. Herb. 1: 293–366. 1895.

[2]McVaugh, Rogers. Edward Palmer, Plant Explorer of the American West. pp. xvii, 430, illus. Univ. of Oklahoma Press, Norman, 1956.

Sciences of Philadelphia (PH). The following account of his itinerary was supplied by Dr. C. Earle Smith, formerly of that institution.

Pennell was in Mazatlán, Sinaloa, on August 16, 1935, and came by train to Ruiz, Nayarit, where on August 17 he collected nos. 19746 to 19750. He continued as follows, in Nayarit except for the collections of August 21, from Quemada, Jalisco: Tepic, August 18–19 (19751–19753); Cerro de San Juan, southwest of Tepic, August 18 (19754–19819); Barranca southeast of Trapichillo, August 19 (19820–19830); Trapichillo, August 19 (19831–19843); San Cayetano, southeast of Tepic, August 20 (19844); Santa María del Oro, August 20 (19845–19875); between La Labor and Santa María del Oro, August 20 (19876–19890); Barrancas west of La Quemada, Jalisco, August 21 (19891–19931); Tepic, August 22–24 (19932–19973); Cerro de San Juan, August 24 (19974–20001). At the conclusion of this work in Nayarit, Pennell returned to Sinaloa and began to collect near Concordia on August 27.

Pérez Cisneros, Roberto. See Muller.

Pérez Jiménez, Alfredo. See McVaugh (1970).

Philbrick, Ralph Nowell. Philbrick, than a student at Pomona College and at the University of California, Los Angeles, collected with Thomas H. Lewis of the U.S. Naval Hospital, Bethesda, Maryland. Philbrick collected first near San Blas and Singaita, December 25–27, 1954 (nos. 401–423). From June 25 through July 5, 1955, Philbrick and Lewis collected nos. 725–827 and 850–852 from the general area of San Blas and nos. 828–847 near Ixtlán (July 3–4). In May 1956 Lewis collected a few more herbarium specimens near San Blas and in February 1957 flew to San Juan Peyotán where he collected several plants on February 7 and 8. In August 1957 Philbrick and Lewis flew to San Juan Peyotán and proceeded southeasterly by muleback into the drainages of the Río Guayavas and Río Chapalagana (For a map of the area explored, see Los Angeles Co. Mus. Contr. Sci. 68: 4. 1963). They collected about 50 specimens, mostly of ethnobotanical interest. "The principal localities where they collected plants between August 10 and 26 were: Las Ranas and La Vuelta, Nayarit, roughly 5 air miles [8 km] south of San Juan Peyotán; Santa Barbara, Nayarit, 15 miles [24 km] south of San Juan Peyotán; Guayavas, Jalisco, 25 miles [40 km] south-southeast of San Juan Peyotán; Rancho de Antonio, Jalisco, 15 miles southeast of San Juan Peyotán, on Río Guayavas; the mission at Santa Clara, Jalisco; San Andrés, Jalisco, 20 miles [32 km] southeast of San Juan Peyotán, just west of the Río Chapalagana." [Data from Philbrick, 1971]. The specimens collected by Philbrick and Lewis are in the Bailey Hortorium of Cornell University (BH).

Phillips, Allan R. A collection of the tree-fern *Hemitelia costaricensis*, made by Phillips in the Arroyo de la Cordoncillera a little south of Puerto Vallarta, in March, 1955, was reported in a note by Morton[1] as an interesting range-extension. Phillips, an ornithologist of Tucson, Arizona, collected the fern in the course of an ornithological expedition.

Pippen, Richard Wayne. See McVaugh (1958, 1960).

Powell, A. Michael. Powell travelled in Mexico in 1961 with J. Edmondson, primarily to gather materials for a revision of the genus *Tridax*. Some of their collections were taken along the highway from Jiquilpan to Guadalajara and Tepic. The first set of their specimens is at the University of Texas (TEX).

Pringle, Cyrus Guernsey (1838–1911). Edward Palmer's first trip to Jalisco apparently attracted the attention of another and equally indefatigable Mexican collector, for in 1888 Pringle made an extended visit to Guadalajara, where he spent 48 days (late October to mid-December). Enthused by the richness of the flora,

[1]Morton, C. V. Tree-ferns in western Mexico. Amer. Fern Journ. 46: 146–148. 1956.

particularly of the deep *barrancas* of the Río Grande, Pringle returned again and again to Jalisco; he made in all more than twenty visits, in fifteen different years from 1888 to 1908. According to the account in his published journal,[1] Pringle worked a total of more than 500 days in Jalisco and collected for distribution more than 900 numbered collections (in sets of 60 as was his practice). One can only guess at the number of smaller sets which he collected, but it must be large, for his journal abounds in references to species which he collected "in dozens," "in 15's," "in scores," and so on. Collection numbers cited in the journal are chiefly those of which full sets were collected. Urbina,[2] on the other hand, in his enumeration of the collections of Mexican plants in the National Museum of Mexico up to about 1895, cites many additional numbers, apparently collected in smaller sets and not mentioned by Pringle in the journal; he includes also many collections, presumably unicates, which are un-numbered. Urbina cites, in all, about 650 collections made by Pringle in Jalisco, including more than 200 not cited by Pringle himself.

No annotated list of Pringle's collections has ever been published, and it has not seemed feasible to summarize by number his collections from Jalisco, because of the gaps and inconsistencies in his numbering system. Only rarely are plants from any one locality all together in a continuous series. Pringle's plan to obtain 60 sets where he could do so often made it impossible for him to obtain more than a few numbers at any one place at one time, so that he traveled much, and planned to return to desirable localities time after time. Thus in 1893 he made six separate visits to Jalisco, and his collection-numbers are correspondingly separated. Numbers which he assigned tentatively, moreover, were often cancelled when he failed to find enough specimens to make 60 sets, and unused numbers were thus relatively frequent. These unused numbers were then on occasion taken up for plants from other localities. Add to this the fact that the principal series, those collected in 60 sets, were numbered separately from the "dozens," the "15's" and the "scores." His collections for any one year may thus be represented by several series of numbers. In 1893, for example, his principal series from Jalisco apparently included nos. 4365–4627; most of these numbers are mentioned in the diaries (Davis, pp. 112–124). In addition to these there are more than 40 numbers between 5370 and 5527, and about 30 un-numbered collections, which are cited by Urbina (1897).

It may be estimated, however, that Pringle added at least 600 species to the known flora of Jalisco. His extensive collections from near Guadalajara, even though all made in the wet season from May to December, make this one of the best-studied localities in Mexico. Most of his time in Jalisco was spent in the vicinity of Guadalajara, where it was his practice to concentrate on the flora of the *barrancas,* while interspersing this work with trips of one day, or over one or two nights, to certain favorite localities within a radius of about 40 kilometers. These favorite and often-visited spots included the Falls of Juanacatlán, and the mountains north of Lake Chapala, which Pringle reached by walking from stations on the railroad. He travelled customarily by rail from one collecting center to another, as pointed out by Pennell,[3] and with few exceptions his collecting trips in Jalisco were made on foot from stations along the railroad, or from a base in Guadalajara. Many details can be obtained from his own diaries as published by Davis.

In 1893, during a stay of more than 165 days in Jalisco, between May 3 and November 18, Pringle made a trip of about a month, by stage from Guadalajara, to

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[1]Davis, H. B. Life and work of Cyrus Guernsey Pringle, pp. [iv], 756, frontisp., University of Vermont, 1936.

[2]Urbina, Manuel. Catálogo de Plantas Mexicanas (Fanerógamas). vi, 487 pp. Mexico, Imprenta del Museo National, 1897.

[3]Pennell, Francis Whittier. Indices of States, Places and Railroad Routes of Mexico. Suppl. to Davis, H. B., Life and Work of Cyrus Guernsey Pringle. pp. 14. Univ. of Vermont, 1937.

Zapotlán and the Nevado de Colima.[1] Later the same year[2] he made two trips, by stage and on foot, to Tequila, where he spent a total of about six weeks in all. Except for a few days in the vicinity of Etzatlán in 1904, these were his only extended trips in Jalisco outside the vicinity of Guadalajara.

The following summary of Pringle's activities in Jalisco is taken primarily from his published journal, which the reader may consult for further details, and for mention of specific localities and collection numbers. The dates as given below are those of his known visits to the State; actual dates of collecting are not cited:

1888 Oct 28–Dec 15
1889 May 20–May 24
1889 Jun 25–Jul 8
1889 Sep 20–Nov 25
1889 Dec 2–Dec 20
1890 May 16–May 24
1890 Sep 8–Sep 12
1890 Oct 31–Nov 4
1891 May 19–May 29
1891 Sep 10–Oct 13
1892 Jun 24–Jun 29
1892 Nov ?10–Nov 26
1893 May 3–Aug 1
1893 Aug 14–Sep 11
1893 Sep 18–Oct 20
1893 Oct 28–Nov 3
1893 Nov 10–Nov 11
1893 Nov 15–Nov 18
1894 Apr 30–May 5
1894 Jul 8–Jul ?13
1895 Oct 9–Oct 12
1898 Jun 9–Jun 16
1901 May 10–May 16
1902 Jul 9–Aug 1
1902 Aug 3–Aug 13
1902 Aug 19
1902 Dec 2–Dec ?12
1903 Sep 26–Oct 29
1904 Oct 21–Oct 31
1905 Nov 28–Nov 30
1908 Sep 25–Oct 7

Puga, Adrián. See Safford.

Puga, Luz María Villarreal de. Resident in Guadalajara with a longtime interest in the flora of Jalisco, Mrs. Puga has collected many specimens, mostly from Jalisco, Michoacán, Nayarit, and Colima, but also some from Chihuahua and Baja California. Her numbered collections since 1960 total about 4500, about 3000 of which are represented in the herbarium of the Escuela National de Ciencias Biológicas (ENCB), or at the University of Michigan (MICH). One of her most interesting discoveries was that of the genus *Ledenbergia* (Phytolaccaceae) in Jalisco (cf. Rzedowski, J., An. Esc. Nac. Ci. Biol. 14: 28–32. 1967). See also McVaugh (1965, 1967), and Rzedowski (1968, 1970).

Puga y Robles Gil, Luis. See McVaugh (1967).

Purpus, C. A. [Karl Albert] (1851–1941). Purpus collected botanical specimens in many parts of Mexico from 1897 until a few years before his death. His work has recently been summarized by Sousa,[3] who does not mention Jalisco among the States in which Purpus collected. Scattered records in the literature, however, indicate that at least his numbers 486–527 came from the vicinity of Tuzpan, Jalisco, about February 1904 (cf. no. 527, the type of *Achaetogeron corymbosus* Larsen, Jour. Washington Acad. Sci. 38: 201. 1948; the specimen is at the Gray Herbarium [GH]). A few of his specimens from Tuxpan apparently bear the date 1905. I have not been able to learn any more about his travels in this part of Mexico.

Reeder, John Raymond, and **Charlotte Goodding Reeder.** Professor and Mrs. Reeder, then of Yale University, collected plants (chiefly grasses) in Mexico in 1950

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[1] Davis, pp. 113–115. See also Pringle's popular accounts of the trip: Pringle, C. G. Notes on Mexican travel VIII. Zapotlán and the Nevado of Colima. Gard. & For. 7: 162–163. 25 Apr 1894; idem.–IX. San Marcos and the Volcano of Colima. op. cit. 7: 172–173. 2 May 1894.

[2] Davis, pp. 115–116, 120–122; see also the description by Pringle under his Notes on Mexican Travel–IX (preceding footnote).

[3] Sousa Sánchez, Mario. Las colecciones botánicas de C. A. Purpus en México. Período 1898–1925. Univ. Calif. Publ. Bot. 51: i–ix, 1–36. 1969.

and again in 1953. Botanical collecting in 1950 was incidental to the collection of soil-samples to be used in the study of actinomycetes. In 1953 the collectors were again interested in obtaining soil-samples, but also travelled widely by truck and obtained many collections of Gramineae, mostly from near the principal highways. The principal set of the Reeders' collections is at Yale (YU).

Collections in 1950 in Jalisco were as follows: 5 miles south of Ojuelos, July 19 (nos. 1400–1401); 18 miles east [northeast] of Lagos, 3 miles east of Presa de Cuarenta, July 19 (1402–1410); 6 miles west of Lagos, July 20 (1411–1419); 10 miles northeast of Zapotlanejo, July 20 (1420); 7 miles northeast of Tepatitlán, July 20 (1421–1423); 10 miles northwest of Guadalajara, on Tepic road, July 21 (1424–1430).

In 1953, after spending some weeks in eastern and southern Mexico, the Reeders travelled from Mexico City to Guadalajara by way of Toluca and Guanajuato, made a side trip from Guadalajara to Colima and the Pacific Coast, then after return to Guadalajara proceeded to Tepic, San Blas, and northward to Durango and Chihuahua. Collections in Nueva Galicia may be summarized as follows:

Jalisco, 13 miles northwest of León, Gto., September 13 (nos. 2288–2293); 7 miles southeast of Lagos, September 13 (2294–2307); 3 miles north of Encarnación de Díaz, September 14 (2308–2310); 1 mile northeast of Valle de Guadalupe, September 14 (2311–2316); various localities between Guadalajara and Acatlán, September 16 (2317–2331); 9 miles south of Guadalajara, September 17 (2332–2335); 18 miles south of Guadalajara, September 17 (2336–2344); between Acatlán and Cuidad Guzmán, September 18 (2345–2352). Colima, between the city of Colima and the lagoon at Cuyutlán, various localities, September 19 (2353–2373); between the city of Colima and Mazamitla, Jal., various localities, September 20 (2374–2389). Jalisco and Nayarit, various localities between Guadalajara and Tepic, September 21 (2390–2409). Nayarit, between Tepic and San Blas, various localities, September 22 (2410–2422).

Professor and Mrs. Reeder have continued their interest in Mexican grasses and have travelled widely in Mexico in recent years.

Reiche, Karl Friedrich (1860–1929). A German botanist perhaps best known for his work on the flora of Chile, Reiche also lived many years in Mexico and was the author of a useful local flora based on his work there.[1]

Reiche went to Chile in 1889[2] and resided there until 1911, when he went to Mexico as Professor of Botany and Biology in the National University. In 1923 he lost this position because of political conditions, and in 1924 he returned to Germany and settled in Munich. In March 1926 he left for his last trip to Mexico, from which he returned to Munich in December, 1927. His experiences in Mexico, and his impressions of that country, are described in a posthumous work.[3] He travelled widely during his earlier residence in Mexico, but I have not seen any references to botanical work in Nueva Galicia except during the trip of 1926–1927. Some of the experiences in "Kreuz und Quer durch Mexiko" certainly date from this trip, but because of the style of narration it is not always possible to be sure. His description of Jalisco, however, in the chapter entitled "Quer durch Jalisco und Colima" (pp. 113–117), seems to be drawn largely from this last trip. He came to Guadalajara by rail from Mexico. He gives some space to a description of Lake Chapala, then takes the reader to Guadalajara, and finally by train to Tonilita. Near Tonilita, at the Hacienda de Esperanza, he made his headquarters for a time in preparation for a climb to the heights of the volcano of Colima. He climbed as far as the beginning of the steeply lying volcanic sands that surround the base of the cone, to an elevation estimated at 3500 meters, at about the upper limit of the lupines and bunch-grasses. He also states that on an earlier occasion he had climbed from San Antonio to the summit of the Nevado.

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[1] Flora excursoria en el valle central de México. pp. 303. México, 1926.

[2] Ross, Hermann. Karl Reiche. Ber. Deutsch. Bot. Ges. 47: appendix 103–110. 1929.

[3] Reiche, Karl. Kreuz und quer durch Mexiko. pp. 128. illus. Deutsche Buchwerkstätten, Leipzig, 1930.

In the chapter "Die Staaten Nayarit und Sinaloa" (pp. 118–121) he describes the train-ride from Guadalajara to Tepic, and refers also to San Blas, which he knew only from having touched there during a trip by sea from Manzanillo to Mazatlán.

Reiche's collection, comprising 1069 numbered specimens, is in the Botanische Staatssamlung at Munich (M), where I examined it in 1954 through the courtesy of the late Professor Suessenguth. Numbers 400 to 420, inclusive, are from the Nevado de Colima, where they were collected in January, 1927.

Reko, Blas Pablo (–1953). The United States National Herbarium has a series of specimens, numbered approximately 4814–4886, collected in Jalisco and Colima between 1923 and 1925 by Reko, an Austrian medical man who made Mexico his adopted country, and who collected extensively in various parts of the Republic. Most of the above collections were made at Hacienda San Antonio, Colima (almost the only specimens I have seen from that locality), or from other localities along the railroad between Colima and Guadalajara. A few collections made in 1922 are from the vicinity of Guadalajara. There is a brief obituary notice in Bol. Soc. Bot. Méx. 16: 25–27. portr. 1954.

Reyes Parra, ————. See Muller.

Roe, Keith, and **Eunice Roe.** Mr. and Mrs. Roe collected in the Sierra del Halo, on the side toward Tecalitlán, in 1965. Their specimens were distributed from the University of Wisconsin (WIS).

Roezl, Benedict (1824–1885). One of the most industrious and widely travelled collectors of American plants for European gardens, Roezl visited Mexico on a number of occasions and lived in that country for extended periods. His first visit was in 1854, when according to his own account he started a nursery for European fruit trees, introduced into Mexico the culture of ramie, and invented and patented a machine for extracting and cleaning the fibers of ramie and hemp. His introductions of horticultural plants to Europe were measured by the tens of thousands of plants, by tons of weight, and by hundreds of species. His botanical publications included numerous newly described species, but were neither detailed nor from a scientific standpoint carefully prepared. A note in Roezl's "autobiography" suggests that he rarely if ever preserved herbarium specimens:

> One thing we beg of M. Roezl, and others who like him can boast of the tons of rare plants they send to Europe, that, ere they exterminate, as they must surely do, the plants from their native haunts, they carefully preserve a few pounds' weight only of dried specimens, to serve as records for the future.[1]

Perhaps on Roezl's later trips to Mexico he was induced to collect at least a few dried plants, for the Kew herbarium is said to possess some of his collections, probably from the trip of 1874 (e.g. *Cuphea hookeriana,* collected at Tepic, and between San Blas and Tepic, cited by Hemsley in Biol. Centr. Am. Bot. 1: 441. 1880).

Some notes on Roezl's early travels in Mexico can be obtained from his so-called autobiography, cited above, and others from his published descriptions of horticultural novelties.[2] There are some additional notes in what is perhaps his best-known botanical work, a catalogue containing descriptions of a large number of new species of the

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[1] Benedict Roezl. Gard. Chron. II. 2: 73. 18 Jul 1874.

[2] Deutsche Gaertner-Zeitung, 1881, p. 118 ff., translated in Belgique Horticole 33: 123–139, 157–177, 221–239, 296–314. 1883, under the title of "Notes sur les découvertes botaniques les plus remarquables faites en Amérique."

genus *Pinus,* including several from the vicinity of Morelia, Michoacán, and others from as far west as northwestern Michoacán.[1]

In the summer of 1854 Roezl collected in various localities in Veracruz and near the city of Mexico. In July 1855 he was collecting at the mountain called Istapalapa, two days' travel from Mexico. In October 1855 he undertook a trip to collect orchids and pine seeds, south of Mexico City. The following month, November 1855, he was in Querétaro. In the summer of 1856 he made a trip to the west of Mexico, crossing the territory of Atacuba; in October 1856 he made a trip to a mountainous region (?near Zimapán) four days from Mexico; in January 1857 he made the ascent of Mt. Acusca (?Ajusco); in February he camped at Zacatlán in the pine forests at 2000 m; in January 1858 he set out for Michoacán, passing through Toluca and scaling the Nevado de Toluca; after a trip of 14 days he reached a place called "Spiritus Sanctus" where there was a rich silver mine and where he found *Pilocereus chrysomallus.*[2] Roezl spent a considerable amount of time on the Isthmus of Tehuantepec, chiefly near a place he called Sante Comapan; he visited Puebla and Oaxaca, climbed Popocatepetl at least to 3500 m, visited the mines of Real del Monte. In 1860 he visited Michoacán and ascended the Volcano of Jorullo; then, as he said, he left Michoacán to undertake an ascent of the Sierra Madre; this was probably in March. He seems to have visited Manzanillo about the year 1868; in his account of his visit in 1874, when describing *Agave ortgiesi,* he wrote:[3]

"Il y a six ans que j'ai récolté au même lieu, pour la première fois, ce magnifique végétal."

In 1868–69 Roezl visited Cuba, returned to Mexico and again to Cuba; he went to New Orleans, Louisiana, in December 1868; crossed from New York to San Francisco probably in the summer of 1869, went after some work in California to Panama and Colombia; at the beginning of the Franco-Prussian war he went to Panama, San Francisco, and Washington Territory, returned to Colombia and Peru, finally to Europe. Leaving Liverpool August 3, 1872, Roezl went to New York, crossed to Colorado and California, collected orchids in the Sierra Madre of Mexico "viâ Acapulco," went on to South America, back to the West Indies and eastern Mexico, then by way of New York to Panama and the Andes before returning to London. On this trip Roezl stated that he sent home 3500 orchid plants from his Acapulco collection; his total shipments included one of eight tons and another of ten tons.

In 1874, in company with his nephew B. Houda, Roezl undertook a long trip to the west coast of Mexico. Leaving Europe on July 15, they crossed the North American continent in a leisurely manner, collecting plants and seeds and arriving in California late in the fall. They left San Francisco by steamer on November 27, touched at San Pedro, San Diego, San Lucas and Mazatlán (December 8) before disembarking at San Blas, where they spent 36 hours making ready for a trip to Tepic. Roezl stayed several days at Tepic, but was prevented by the authorities from traveling farther into the interior; he was especially disappointed not to be able to visit the volcano "Cherubusco" [Ceboruco], then active. He returned to San Blas and continued by boat to Manzanillo, where he hired mules for the trip to Colima.

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[1]Catalogue des graines de Conifères Mexicains, qui se trouvent chez J. Roezl et Co. à Napoles près Mexico. M. Murguia, Mexico, 1857. pp. 34. [The title as given is taken from Schlechtendal, who published a translation from French into Latin of all the descriptions of new pines (Schlechtendal, D. F. L. de, Coniferae Mexicanae, ex catalogo clar. Roezl translatae, &c. Linnaea 29: 326–356. 1858). See also Shaw, G. R., Pines of Mexico. Arnold Arb. Publ. 1: 3. 1909.]

[2]Perhaps Roezl meant the mine called Espíritu Santo, in southern Michoacán not far from the Río Balsas, west of Huetamo and north of Zirándaro. See Candollea 13: 197. 1951.

[3]Belg. Hort. 32: 90. 1882.

After a few days spent in Colima to put his affairs in order, Roezl determined to ascend the Volcán de Colima to search for orchids. His party left Colima about December 21 and stayed the first night not far beyond the Indian village in the orange belt near the foot of the mountain. The second day, after passing evidences of volcanic action on the lower slopes, they ascended into a virgin forest where they found orchids in abundance.[1] The second night was spent in the open, after the travellers had left their pack-animals behind; the third night in the oak forest at an elevation of 2340 m. The following day, December 24, the party climbed into the fir forest to an elevation of about 3000 m and passed one more night there before beginning the three-day trip back to Colima. Here Roezl suffered an attack of fever which kept him in bed for a week. In the meantime Indian collectors were gathering orchids for him, and by the middle of January, 1875, he had more than 10,000 good plants of choice species to export. Two months later, early in March, he had packed and shipped 100,000 orchids, including 22,000 specimens of *Odontoglossum cervantesi.*

Roezl then determined to ascend the volcano by another route, and set out from Colima on March 8, traveling the old *camino real* to Guadalajara. He reached Tonila ("Tonilla") the first night, and began his ascent from there the following morning. He travelled relatively rapidly upward through the pine and fir zones, and by nightfall had reached an altitude of 3400 m. After a night much disturbed by the eruptions of the volcano, Roezl left the animals with the guides, and climbed with his nephew to the summit ridge, some 300 meters below the peak of the Nevado, before returning to the previous night's encampment. The return to Tonila was delayed a day by a river of molten lava around which the travelers had to detour.

Roezl arranged to have 1000 plants of *Cypripedium irapeanum* brought in for packing, and while he was waiting for these he passed around the flank of the mountain to Zapotlán ("Zapotitlan"), a two-days' journey from Tonila, and after a short visit to the city ascended the mountains to the eastward before returning to Tonila. After packing his collections in Colima he embarked soon at Manzanillo and returned to Europe by way of California.

Roller, Jane. See Weintraub.

Rose, Joseph Nelson (1862–1928). Rose's trip across the Sierra Madre in 1897, with Nelson (q.v.) and Goldman, has already been mentioned. This was, botanically speaking, one of the most profitable ever made in Nueva Galicia. His collections comprised the only large series ever obtained from this part of Mexico, and one of the most important, because they represent the flora of a large area, even now very imperfectly known, between the Sierra Madre Occidental of Chihuahua and Durango, and the more southerly ranges that are bounded on the north by the *barrancas* of the Río Grande system. Rose's collection was only partially studied by him before his death in 1928, and many novelties will doubtless be found in it in the future. Plants were collected at the following localities, beginning at Aguacate about ten miles east of the Río San Pedro (Goldman, p. 202):

Aguacate to Dolores, August 6, 1897 (nos. 2013–2030, 3332, 3348–3362, 3424); Dolores, August 6 (3363–3366); Dolores to Santa Gertrudis, August 7 (2031–2065, 3367–3374, 3423); near Santa Gertrudis, August 7 or 8 (3406, 3407, 3411); Santa Gertrudis to Santa Teresa, August 8 (2066–2121, 3323, 3375–3385); near Santa Teresa, August 8–13 (2122–2234, 3313, 3386–3405,

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[1]Roezl's narrative was published in Deutsche Gaertner-Zeitung 4: 11–12, 34–36, 58–60, 78–79, 105–108, 129–131, 154–155, 180–181, 227. Jan–Oct 1880, as "Meine letzte Reise an der Westküste von Mexiko." A translation, by Dr. H. F., "Mon dernier voyage à la côte occidentale du Mexique," appeared in Belgique Horticole 32: 68–113. 1882. A portion of the article, that describing the ascent of the volcano, was translated into English by W. B. Hemsley and published, in abridged form, with the title "Ascent of the Volcan de Colima," in Gard. Chron II. 19: 369. 24 Mar 1883, and op. cit. 415–416. 31 Mar 1883.

3408–3410, 3412–3418, 3425–3454, 3456–3466, 3737, 3745, 3770, 3772, 3791); Sierra Madre near Huazamota, Durango, August 13–16 (2235–2360, 3455, 3467–3519, 3523, 3752–3754, 3793); Sierra Madre, Zacatecas (see Goldman, p. 288), August 16–18 (2361–2403, 3520–3522, 3524–3533, 3535, 3736, 3756, 3764); near San Juan Capistrano, Zac., August 18–22 (2404–2485, 3534, 3536–3557, 3762); Zacatecas, between San Juan Capistrano and Huejuquilla, August 23 (2486–2495, 3751); Jalisco, between San Juan Capistrano and Huejuquilla, August 23 (2496–2519); Huejuquilla, August 24–25 (2520–2556, 3558–3565, 3773, 3781); Huejuquilla to Mezquitic, August 25 (2557–2592, 3566–3578, 3771, 3775); Mezquitic, August 26 (2593–2596, 3579); Mezquitic to Monte Escobedo, August 26 (2597–2662, 3580–3588); near Monte Escobedo, August 26–28 (2623–2668, 3589–3595, 3760, 3769); Monte Escobedo to Colotlán, August 28 (2669–2677, 3596–3601); near Colotlán, August 28–30 (2678–2681, 3602–3610); Jalisco, between Colotlán and Plateado, August 31 (2682–2692, 3611–3618[1]); Zacatecas, between Colotlán and Plateado, August 31 (2693–2710); Plateado, September 1 (2711–2712); Sierra de los Morones, September 1 (2713–2743, 3619–3631); Plateado, September 2–4 (2744–2807, 3632–3650, 3740–?3744); Plateado to Colotlán, September 5 (3651–3655); Colotlán, September 6–7 (2808–2820, 3656–3665, 3776); Colotlán to Bolaños, September 7–8 (2821–2844, 3666–3677, 3681, 3765); Bolaños, September 9–19 (2845–2943, 3679–3680, 3682–3700, 3746, 3780); Sierra Madre west of Bolaños, September 15–17 (2944–3015, 3701–3730, 3732, 3738–3739, 3767); Jalisco, between Bolaños and Guadalajara, September 19–20 (3016–3031, 3731, 3733–3735), September 21–22 (3045–3068); Zacatecas, between Bolaños and Guadalajara, September 20–21 (3032–3044); Bolaños to Guadalajara, September 20–22 (3079–3098); Guadalajara, September 24 (3099).

Rose made a second journey to Mexico, May 9 to July 15, 1899, in company with Dr. Walter Hough, of the United States National Museum (Contr. U.S. Nat. Herb. 8: 1. 1903). They came to Jalisco by train, after collecting in the State of Puebla until June 27. They worked in the vicinity of Tequila, July 5 and 6, collecting nos. 4740–4796 and 4979–4980; at Orendain, July 7 (4797–4802); at Guadalajara, July 9 (4803–4805 and 4981–4982), in the *barranca* near Guadalajara, the same day (4806–4833); and at Ocotlán, July 10 (4834). The following day, July 11, they began to work near the city of Guanajuato.

In 1901, accompanied by Robert Hay, Rose travelled in Mexico from June 26 to August 31. The two men collected near the city of Aguascalientes, August 20 (nos. 6197–6239). Returning immediately to México, they collected on Popocatepetl, at elevations between 8600 and 10700 feet, on August 22 (nos. 6240–6264). The next numbers are from Guadalajara, August 24 and 25 (6265–6294 or 6295, 6401, 6402, 6404), and August 26–27 (6372, 6373). Nos. 6296–6322 are from Popocatepetl, August 22. No. 6374, according to the field-book, is from Poncitlán, Jalisco, under dates of August 1 and 2; there is perhaps some error here, since the book also shows that numerous collections were made on these latter dates at Tehuacán, Puebla.

Somewhat more extensive collections were made in 1903 by Rose, who was then assisted by J. H. Painter. A summary of their joint collections follows:

Near Guadalajara, September 26 (7314–7345); near Guadalajara, September 27 (7346–7348); Barranca near Guadalajara, September 28 (7349–7425); Barranca near Guadalajara, September 29 (7426–7443); Río Blanco, September 30 (7444–7509); mountains near Etzatlán, October 2 (7510–7601, 7699); near Atequiza, October 4 (7602–7605); between Atequiza and Chapala, October 4–6 (7606–7613, 7696); chalky hills near Chapala, October 5 (7614–7638); Chapala, October 5 (7639–7670); hills beyond Chapala, October 5 (7671–7695); near Atequiza, October 6 (7697, 7698); hills east of Aguascalientes, October 9 (7700–7779), near Aguascalientes, October 9 (7801), west of Aguascalientes, October 10 (7780–7800).

Rose and Painter worked for a part of the time with C. G. Pringle and sometimes also with the mycologist Holway. Comparison of their dates and localities with those in Pringle's diary (Davis, p. 209), shows that Pringle, Holway and Rose were together in the Barranca de Ibarra, north of Atemajac, on September 28 and 29, and that all travelled together to Etzatlán. Apparently Pringle did not accompany Rose and Painter on their trip to Chapala. In some instances it appears that Pringle and Rose collected

[1]Perhaps partly in Zacatecas.

the same species at the same locality (cf. *Pringle 8766,* and *Rose & Painter 7531,* both from Etzatlán, both representing *Cuphea hookeriana*).

The summaries of Rose's collections for the years 1897–1899, 1901, and 1903, have been drawn from his field-books, generously made available by the United States National Herbarium, where is also the only nearly complete set of his plants. It was not his custom to collect large sets of duplicate specimens; many numbers are represented only by the specimen in the National Herbarium, and rarely does a number consist of more than five sets. The largest set of his duplicates is probably at the Gray Herbarium (GH). Smaller sets went to New York (NY), to Kew (K), to Mexico (MEXU), to St. Louis (MO), and to the British Museum (BM). The serial numbers on the specimens are those of Rose himself, although the plants of 1899, 1901 and 1903 were distributed under the names of Rose & Hough, Rose & Hay, and Rose & Painter, respectively.

Ross, Gordon Burwell. Ross collected approximately 150 specimens in southern Mexico, and presented these to the United States National Herbarium in 1955. About 28 numbers were from Jalisco, and most of these from the vicinity of Puerto Vallarta.

Ross, Hermann (1862–1942). In connection with the Tenth International Geological Congress, held in Mexico City in 1906, an excursion was arranged to the Volcán de Colima. Ross, a member of the staff of the Botanical Garden (now Botanische Staatssamlung) of Munich, took part in this excursion and collected a number of plants. His collections for the entire summer (from this and other excursions) include more than 600 numbers of flowering plants, which are deposited in the Munich herbarium (M). The specimens are serially numbered, more or less chronologically, and an alphabetical list (by plant-family and genus) is preserved at Munich. Through the kindness of the late Professor Suessenguth I was able to consult this list and determine the localities for specimens already in the herbarium. It appears that the specimens collected in Jalisco number approximately 136 (nos. 415–550), or perhaps fewer. Numbers preceding this (up to at least 427), were collected in the Sierra de San Andrés, Michoacán, and numbers beginning with 551 were collected in Veracruz, near Córdoba and Mirador. A series from about 445 to 459 came from the vicinity of Zapotlán, Jalisco, and nos. 490 to about 536 came from the northeastern slopes of the Nevado de Colima, especially near the Rancho de la Joya and on up to the "saddle" by which one crosses the divide between the Nevado and the "Volcán de Fuego." There are many gaps in the series between 415 and 550; some of these are known to be non-vascular cryptogams, and the remaining numbers may have been assigned to plant-galls (Ross's principal field of interest) or to zoological or geological specimens.

The excursionists for the Volcán de Colima left Celaya, Gto., in a special train, and arrived in Guadalajara on August 26, 1906.[1] They continued by train to Zapotlán, where they passed the day of the 27th. The Governor of Jalisco personally attended them here, and accompanied them on a short trip to the volcanic craters of Apaxtepetl. At 6 o'clock on the morning of the 28th the party left on horseback for the mountain, going by way of the Rancho de la Joya, where they stopped for lunch. In the afternoon they continued through the pass called Los Colimotes and turned the south flank of the Nevado, to a camp which they reached about 6 in the evening. The day of the 29th was given up to an ascent of the volcano proper, and the night was passed at the same camp as before. On the 30th they descended by way of the Barranca of Atenquique, reached Zapotlán during the night and took the train at once for Guadalajara.

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[1]Compte Rendu X^{me} Sess. Congr. Geol. Int. [México 1906] 2: 1298. 1907.

Ross obtained some of the characteristic high-altitude plants (e.g. *Draba jorullensis, Festuca tolucensis, Pernettya ciliata, Vaccinum geminiflorum*) on the open slopes of the saddle, near the camp of August 28 and 29. The flowering plants have been little cited in the literature, although the grasses were identified by A. S. Hitchcock, and the oaks by William Trelease. A paper on the cryptogams was published by Ross and collaborators.[1] For a sketch of the life and work of Ross, there is a paper by Suessenguth.[2]

Rowell, Chester Morrison, Jr. In the summer of 1947, Dr. Fred A. Barkley, who was at that time a member of the staff of the University of Texas, conducted a collecting trip in Mexico. He was accompanied by several University students, including John B. Paxson, C. M. Rowell, Jr., Grady L. Webster and B. L. Westlund. The many collections which were made by the party are now in the herbarium of the University, at Austin (TEX). Most of the labels bear the names of three collectors, headed by that of Barkley, e.g. "Fred A. Barkley, B. L. Westlund & C. M. Rowell, Jr. 7618," or "Fred A. Barkley, John B. Paxson & Chester M. Rowell, Jr. 7605." According to the numbering system used by the group, the serial number is that of the collector whose name appears last on the label (i.e. next to the number). The specimens collected in Jalisco by this party were all assigned numbers in Rowell's series, and accordingly his name is written next to the serial number on each label.

Approximately 169 numbers were collected in Jalisco, on August 12, 1947, near the highway from Guadalajara to Morelia. The following list of numbers and localities was sent me by Dr. Rowell, and the entire series of specimens was loaned for my study by the late Dr. B. C. Tharp:

> Five miles south of Guadalajara, xeric scrub near highway (nos. 7492–7553); marsh beside road about 10 miles southeast of Guadalajara [It is probable that this locality was near Santa Cruz de las Flores, which is almost southwest of Guadalajara, not southeast; marshy areas are conspicuous here along the highway] (7554–7578); 5 miles southeast of Jocotepec (7579–7581); 15 miles southeast of Jocotepec (7582–7591); in pool beside road, 30 miles southeast [i.e. 30 miles by road from the city] of Guadalajara (7592–7601); mountainsides above southern shore of Lake Chapala (7602–7660); 10 miles west of Zamora, Michoacán (7661–7669).

Rowntree, Lester. Mrs. Rowntree, an author, horticulturist, and garden consultant of Carmel, California, collected seeds, living plants and herbarium material in Mexico during the autumn months (September to December) of 1938, paying particular attention to plants which might be expected to do well in California gardens. Her entire herbarium, including nearly 1000 sheets, was later destroyed by fire, but at least a few specimens were distributed and some have been cited, e.g. a number of Labiatae, including numbers from 111 to 273, mostly from Jalisco and Michoacán (cf. Epling, Carl C., in Rev. Mus. La Plata II, 7 [Bot.]: 196. 1949, and Bull. Torrey Bot. Club 67: 509–534. 1940).

Russell, Paul George (1889–1963), and **Max J. Souviron** (1898–). These plant-explorers for the United States Department of Agriculture reached Guadalajara by train on August 14, 1930, and left for Mexico City the night of the 15th. They spent as much time as possible, on the 15th, collecting in the Barranca de Oblatos. The botanical specimens, now in the United States National Herbarium, were made by Russell and distributed under the names of Russell and Souviron.

Rzedowski, Jerzy. Professor Rzedowski, a member of the faculty of the Escuela Nacional de Ciencias Biológicas, México, has made more than 15 trips to Nueva Galicia since 1960, and has collected more than 3000 numbers, the first set of which is in the

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[1] Contributions à la flore du Mexique avec la collaboration de spécialistes. Mem. Soc. Cient. "Antonio Alzate" 32: 155–199. 1912.

[2] Hermann Ross. Ber. Deutsch. Bot. Ges. 60 (2): 177–185, portr. 1943.

herbarium of his institution (ENCB). A considerable duplicate set is at the University of Michigan (MICH), and other sets have been distributed. His longest excursions to our area were in 1960, when he collected more than 1000 numbers, traveling with a party from the University of Michigan (see McVaugh, 1960); from June 20 to July 1, 1961, when he collected more than 250 numbers; from October 21 to November 25, 1963, when he took approximately 679 numbers; and from October 24 to November 1, 1967; other important trips were those to San Martín de Bolaños (August 31–September 3, 1968), and to Cerro Viejo (August 14–16, 1970).

In 1960 Rzedowski's travels closely paralleled our own, but our collecting localities were not always identical. He took nos. 14001–14075 along the Aguascalientes-Calvillo highway (August 24–25), 14116–14181 in the Sierra del Laurel (August 26–28), 14183–14209 on a trip to Jalpa (August 30), 14213–14248 at the Presa de Santa Rosa (September 1) and 14249–14261 at El Molino (September 2). On the trip to Tepic and Compostela he collected nos. 14262–14400 (September 3–6). When we met in Guadalajara 3 weeks later he collected at Santa Cruz de las Flores and in the lake-basins south of Acatlán and Cocula (nos. 14500–14527, September 26–28). On our travels to Autlán and the coast, September 29–October 4, he collected nos. 14531–14744. After a short respite he rejoined our party on November 11, in time to collect with us on our trip to Tenacatita Bay on the 12th (nos. 14846–14911). He then accompanied us to Talpa and La Cuesta, collecting along the road to Autlán (nos. 14912–15051, November 13–16), near Cuautla (nos. 15052–15064, November 17), between Talpa and La Cuesta (nos. 15065–15169, 15207–15247, November 18–22, 24–25), and near Llano Grande (nos. 15170–15206, November 23).

In 1961, Rzedowski came into Jalisco by automobile, via Atotonilco (nos. 15248–15256, June 20), and Guadalajara (along the highway to Ixtlahuacán del Río and beyond, nos. 15257–15269, June 21), Zacoalco and Tapalpa (nos. 15270–15279, June 22), Tecalitlán and Pihuamo (nos. 15280–15326, June 23–24). For the next three days he explored in different directions from the City of Colima, taking nos. 15328–15342 on a trip to Tonila, Jalisco (June 25), 15343–15361 on the road to San Antonio (June 26), and 15362–15385 on an excursion toward Pihuamo (June 27). The following day (June 28) he went toward the coast and on that day and the 29th collected nos. 15386–15465 near Tecomán, Los Pascuales and Cerro de Ortega, and in the foothills between Tecomán and Manzanillo. After an excursion on the 30th, beyond Manzanillo toward Cihuatlán, he returned the next day to Colima and Jiquilpan (between Tecomán and Cihuatlán, nos. 15466–15488; northeast of San José de Gracia, July 1, 15494–15506).

On a second trip to Jalisco this summer, Rzedowski collected for two days with L. E. Detling (q.v.) on July 20 near La Primavera (nos. 15489–15493; Detling collected his nos. 8449–8451), and on July 21 near San Juan Cozalá (nos. 15510–15514; Detling nos. 8452–8453).

In February, 1962, Rzedowski travelled along the highway from Tepic to Guadalajara and León, Guanajuato, collecting especially in the vicinity of Tepic and along the highway as far as Tequila (nos. 15586–15639, February 11–12), between Zapotlanejo and Pegueros (nos. 15640–15651, February 14), from San Miguel el Alto to Lagos, Encarnación de Díaz and León (nos. 15652–15661, February 15–16).

On September 25, 1962, Rzedowski collected nos. 16117–16211, near Ojuelos and on the road to Aguascalientes. In March and April, 1963, he was in Jalisco twice, the first time taking nos. 16325–16341 near Lake Chapala and near Atotonilco (March 22–24), and on the second trip collecting nos. 16562–16587 about 5 km east of Puerto Vallarta (April 27). On a third trip to Nueva Galicia, nearly a month later, he spent 8 days in the region between Apatzingán and Coalcomán, taking nos. 16607–16656 between Apatzingán and Tepalcatepec and along the road to Jilotlán

(May 20–23), and nos. 16657–16716 in the Municipio de Coalcomán or along the highway from Tepalcatepec to Coalcomán (May 24–27).

In October 1963, Rzedowski joined a University of Michigan expedition conducted by Feddema and Mrs. Dieterle. With them he collected first on an excursion from Apatzingán to Tepalcatepec and the Sierra de los Corales (nos. 17308–17526, October 21–27). The party then transferred its attention to the high grasslands of northern Jalisco and adjacent Zacatecas, Rzedowski collecting between Valparaíso and Huejuquilla and near Huejuquilla (nos. 17527–17645, October 30–November 3), near Mezquitic, and between Mezquitic and Monte Escobedo (nos. 17646–17717, November 3–6). Moving to southern Nayarit, the party traveled from Tepic to Puerto Vallarta on November 10, when Rzedowski collected nos. 17719 between Mazatán and Las Varas, and 17720 in Mpio. Valle de Banderas. The party collected from Puerto Vallarta as a base for the next 8 days; Rzedowski took nos. 17721–17765 (November 11–12), nos. 17766–17782 (November 13, on an excursion over the new highway to Tomatlán), nos. 17783–17830 (November 14–16, including an excursion via El Pitillal and El Milagro in the direction of Mascota), and nos. 17831–17880 (November 17–18, at San José and El Cuatante, Mpio. Valle de Banderas). Returning to Tepic on November 20, Rzedowski took nos. 17881–17916 between Mazatán and Las Varas. On the final excursion of this year, the group proceeded via Guadalajara, Colima, and Tecomán to the coast of western Michoacán, where they spent 3 days. Rzedowski took nos. 17917–17941a (near Chila, November 23), 17942–17971 (near Cruz del Campo, November 24), nos. 17972–17986 (near San Juan de Lima, and on the return to Colima, November 25).

In January 1964 Rzedowski made a short but interesting trip to Aguascalientes and southern Zacatecas, collecting few specimens (nos. 18250–18264, January 23–25), but visiting for the first time the limestone mountains near Asientos, and then proceeding by way of Aguascalientes and Calvillo to Jalpa and Juchipila, near which latter place he discovered the very distinctive new species of pine, *Pinus maximartinezii.*

In 1965 and 1966 he visited Nueva Galicia briefly on four occasions. On an ascent of the Nevado de Colima, January 10, 1965, he collected nos. 19349–19403. Near the highways north and west of Guadalajara he collected nos. 20238–20283 (south of Moyahua, July 25, 1965, and La Primavera, July 27, 1965). On February 5 and 6, 1966 he visited the *barrancas* near Atenquique and collected nos. 21866–21952. On a three-day trip in May 1966, he ascended the Nevado de Colima to above the tree-line (May 2, nos. 22222–22284), then collected for two days along the highways between the area of Apatzingán and that of Uruapan (May 3–4, nos. 22286–22330).

In the course of a 9-day visit to Jalisco, Colima, and Aguascalientes, beginning in October, 1967, Rzedowski went first from Guadalajara to Colima and the coast, collecting nos. 24925–24971, chiefly near Barra de Navidad, San Patricio Melaque and Playa de Oro (October 24–28). He then went to northern Aguascalientes, where he worked for two days in the interesting mountains between Tepezalá and Asientos, where the limestone and volcanic rocks are adjacent (nos. 24972–25089, October 31–November 1), before leaving the area by way of Aguascalientes and Ojuelos (nos. 25090–25103, November 1).

On his two most recent excursions to Jalisco, on both occasions accompanied by Sra. de Puga, Rzedowski visited relatively inaccessible localities from which additional collections were badly needed. On August 31, 1968, he flew in to San Martín de Bolaños, and collected nearby nos. 26080–26122 (also nearby, on September 3, 26247–26249). The party then walked to El Platanar, a small village about 4 km west of San Martín, and from there ascended the trail in a northwesterly direction via Las Treinta Vueltas and Los Yerbanís, to a place called Las Vidrieras, in the pine-oak forest in the higher mountains. Rzedowski collected nos. 26123–26147 (Los Yerbanís,

September 1), 26148–26202 (Las Vidrieras, September 1), 26203–26235 (Las Treinta Vueltas, September 2).

On his most recent excursion of which I have record, Rzedowski ascended Cerro Viejo from Cuyutlán on the north side of the mountain. He collected nos. 27453–27583, August 14–16, 1970; about half his plants came from the lower slopes above Cuyutlán, and the rest from the upper part of the peak, up to an elevation of more than 2900 m.

Safford, William Edwin (1859–1926). To study and collect the cacti of Mexico, Safford travelled in that country in 1907. An informal synopsis of his travels may be found in his *Cactaceae of northeastern and central Mexico.*[1] He writes of his visit to Guadalajara, his meeting with Adrián Puga, his introduction to various species of cacti found locally in gardens and in the markets. His collections of botanical specimens from Jalisco are numbered from 1375 to 1463. These were collected during the last six days in February, mostly from the *barrancas* near Guadalajara. The specimens are in the United States National Herbarium.

Santana V., Miguel. See McVaugh (1952).

Schaffner, [J. G.?] According to a report in Candollea 6: 108. 1936, a specimen of *Cestrum porphyreum* in the herbarium at Hamburg (HBG) was collected at Tepatitlán by a collector named Schaffner, not otherwise identified. J. G. Schaffner (1830–1882), a native of Germany, lived in Mexico for 30 years and collected extensively in San Luis Potosí and elsewhere in eastern Mexico. In the Gray Herbarium (GH) there is at least a small series attributed to Schaffner, collected near Mazatlán, Sinaloa. Rzedowski[2] states that collections from Guadalajara, although attributed to Schaffner, were probably made by Leonardo Oliva, q.v. There seems to be no real evidence that Schaffner ever collected in Nueva Galicia.

Schery, Robert Walter. In the summer of 1941 Schery, then engaged in taxonomic studies of the genus *Malvaviscus,* travelled in Mexico by automobile. Most of his work was in eastern Mexico, but one side trip was made to Guadalajara, and some herbarium specimens were obtained. In our area, as far as known, these were taken mostly near the highway along the south side of Lake Chapala. The specimens were given to the Missouri Botanical Garden (MO), and some duplicates have been distributed.

Schiede, Christian Julius Wilhelm (1798–1836). See Ehrenberg.

Schott, Arthur (1814–1875). Reported to have collected in the "Sierra de Nayarit, Jalisco" (Ann. Missouri Bot. Gard. 24: 410, 413. 1937), on June 18, 1855. Schott was one of the collectors of the Mexican Boundary Survey, who on the date in question was collecting in the Sierra del Pajarito near the boundary between Arizona and Sonora. This is known from collections of other species, taken the same day at the same locality, e.g. *Prunus serotina* var. *virens* (Brittonia 7: 306. 1951). Schott was one of a party that ran a survey line eastward from the Colorado River through the deserts, in the spring of this year. They finished their work near Fort Yuma about the middle of January. In mid-April they were ready to begin the survey from a point about 20 miles below the junction of the Gila and Colorado River (letters from Schott to Torrey, 18 Jan 1855 and 18 Apr 1855).

The references to the Sierra de Nayarit, and to Jalisco, are evidently completely in error.

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[1] Smithson. Rept. 1908: 525–563. *pl. 1–15.* 1909.

[2] Rzedowski, J. Las colecciones botánicas de Wilhelm (José Guillermo) Schaffner en San Luis Potosí. I. Acta Científica Potosina 3: 99–121. 1959.

Seemann, Berthold (1825–1871). As the botanist of H. M. S. "Herald," Seemann was able to collect in western Mexico on two trips.[1] The first was of a few days only (November 26–December 4, 1848). Seemann went from Mazatlán to San Sebastián (at an elevation supposed to be 1000 feet), thence a day's journey to the Hda. de las Naranjas at the foot of Cerro del Pinal, where he stayed two days to collect among the oaks and pines, returning in good time by the same route, via Santa Catarina, Nanches, and San Sebastián. As far as I know the exact location of Cerro del Pinal has never been reported by any botanist since Seemann's time, although he obtained some very interesting plants there.

On the second trip into the interior, November 23, 1849 to February 22, 1850, Seemann travelled from Mazatlán to Durango by a route very nearly that of the modern highway. When he reached the heights west of the City of Durango "everything partook of a wintry aspect," and [he] "soon became aware that [his] principal harvest was over." The vicinity of Durango proved equally disappointing for his purposes, so he turned southward. The following is from the *Botany of the Herald* (p. 260):

> I now took a south-western direction, the little-frequented road from Durango to Tepic. Departing from Durango on the 2nd of January, 1850, I reached on the 5th of the same month San Franzisco de Mesquital . . . having passed that place one enters a desolate district; there are no houses, no people; the road becomes mountainous and very badly marked, as it is only trodden by a few Indians, the principal communication between Durango and Tepic being carried on by way of Guadalajara. I collected however a good many specimens, the vegetation not having suffered so much from drought and frost as in that part of the Sierra Madre which I crossed when coming from Mazatlan. On the 12th of January I reached the village of Santa Teresa, about two days' distance from Tepic, and inhabited by the Coras, a tribe of Indians whom the Jesuits converted to Christianity. . . . I remained five days with them, proceeded to within a day's distance of Tepic, and then returned to Durango, taking a different route, which conducted me to a place termed Guajolote, also inhabited by Indians. I left Durango on the 13th of February for Mazatlan. . . .

The *Botany of the Herald* is an important source-book for all floristic studies in western Mexico, especially for the family Compositae, in which over 30 new species were described by Schultz Bipontinus. It is all the more frustrating that it is usually impossible to ascertain the exact locality at which any given specimen was collected. Nearly full sets of Seemann's plants are at Kew (K) and the British Museum (BM), and additional duplicates are at the Gray Herbarium (GH), in the herbarium of Schultz at Paris (P), and elsewhere, but most of them are labelled merely "Sa. Madre N.W. of Mexico." Some in Hooker's herbarium (at Kew) are labelled "Cerro del Pinal," but I have never seen any other definite locality recorded on a specimen.

The citations in the published "Flora of north-western Mexico" are not more helpful; most species are cited simply as from the "Sierra Madre," although a relatively few are identified as from Mazatlán, Santa Lucía, Cerro del Pinal, Durango, or "road from Mazatlán to Durango." About a score are definitely identified as from the area between Durango and Tepic (e.g. "Durango to Tepic," *Gaudichaudia schiedeana, Euphorbia recta, Ipomoea murucoides, Mimulus madrensis, Cornus grandis;* "Durango to Santa Teresa," *Helianthemum glomeratum;* "Between Mesquital and Tepic," *Cupressus thurifera;* "between Mesquital and Santa Teresa," *Pinus patula;* "Santa Teresa," *Poinsettia pedunculata, Acacia glabrata, Gerardia pedunculata;* "Mesquital," *Cowania mexicana*).

To judge from those cited by Seemann, he secured approximately 200 collections on his trip to Durango in 1849–50. Because of his comments about the poor collecting near Durango and in the high mountains between Durango and Mazatlán,

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[1]Seemann, Berthold. The botany of the voyage of H. M. S. Herald, under the command of Captain Henry Kellett, . . . 1845–51. pp. i–vi, 5–483. *pl. 1–100.* London, 1852–1857. [Flora of north-western Mexico, pp. 255–346, publ. 1856].

and his remark that he collected "a good many specimens" during his trip of almost a month toward Tepic, it seems likely that half or more of all his collections from the "Sierra Madre" came in fact from the mountains south of Mezquital, in extreme southern Durango or northeastern Nayarit.

Seler, Eduard (1849–1922). A noted German archaeologist, Seler made several long trips to Mexico and Central America, primarily to explore in his own field. In the course of his first two trips (1887–1888 and 1895–1897), he passed briefly through Nueva Galicia and on each occasion collected a few plant-specimens. On both of these expeditions Seler was accompanied by his wife, Frau Caecilie (Sachs) Seler (1855–1935). On the first trip the Selers accumulated, in addition to their archaeological materials, more than 900 numbered collections of herbarium specimens; on the second trip the botanical collections were even more numerous. The plants collected on these and later expeditions were made the subjects of papers entitled *Plantae Selerianae,* prepared by Theodor Loesener with the collaboration of specialists.[1] The expeditions themselves, and the archaeological results of the work, have been described elsewhere.[2]

The Selers left St. Louis, Missouri, travelling by train, on October 21, 1887. They went directly to Santa Fe, New Mexico, thence after a few days' work to El Paso, Texas. They left El Paso the night of November 10 and continued by train to Mexico City. Their stops were limited ones, but a number of plants were collected at various localities along the railroad on November 11 and 12, especially in the States of Chihuahua, Zacatecas, and Aguascalientes. On November 12, as far as may be inferred from the account under this date in Seler's *Reisebriefe,* travel was from a point north of the city of Zacatecas, through Aguascalientes and later through a station called Serrano, to the evening stop in León, Guanajuato.

Apparently no more than three collections (nos. 565, 575, and 581) are cited in *Plantae Selerianae* as from "Serrano, Jalisco." I have not been able to locate a place of this name except Serrano, Guanajuato, a locality near the railroad between Irapuato and Silao. Although Seler's description of "Station Serrano," as a place where garden products were much in evidence, suggests a locality in the rich valley of Guanajuato, his mention of Serrano precedes that of León and so implies that Serrano lay between León and Aguascalientes, and presumably in Jalisco. Serrano does not appear in Bárcena's list of populated places in Jalisco (An. Min. Fom. Rep. Mex. 9: 34–203. 1891), nor on any map of the state at my disposal.

Some weeks later (February 4, 1888) the Selers passed briefly through a corner of Jalisco, but as far as I know they collected no plants at this time. They came to Lagos by train from Querétaro, took the stage to Ojuelos, where they spent the night, and continued the following day toward San Luis Potosí.

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[1] Loesener's *Plantae Selerianae* was issued in reprint form with continuous pagination, in addition to the pagination of the volumes in which the separate parts originally appeared. Following are the two sets of pagination, with that of the reprint in square brackets: Bull. Herb. Boiss. 2: 533–566. 1894 [1–34]; op. cit. 3: 609–629. 1895 [35–55]; op. cit. 7: 534–553. 1899 [56–75]; op. cit. 7: 561–579. 1899 [76–94]; op. cit., ser. 2, 3: 81–97. 1903 [95–111]; op. cit. 208–223. 1903 [112–127]; op. cit. 278–287. 1903 [128–137]; op. cit. 6: 831–871. 1906 [138–178, by error un-numbered, 177, 140–176, 139–140]. Beginning in 1909 the series was continued in another journal, as follows: Verh. Bot. Ver. Brandenb. 51: abh. 1–36. 1909 [179–214]; op. cit. 53: abh. 50–86. 1911 [215–251]; op. cit. 55: abh. 151–194. 1913 [252–295]; op. cit. 58: 129–157. 1917 [296–324]; op. cit. 65: 84–122. 1923 [325–363].

[2] For the trip of 1887–1888, see Seler, Eduard, Reisebriefe aus Mexiko, i–iv, 1–267 pp., illus., Verlag von Ferd. Dümmler, Berlin, 1889; for an account of the trip of 1895–1897, see Seler, Caecilie, Auf alten Wegen in Mexiko und Guatemala, XXVI, 363 pp., 65 pl., map. Dietrich Reimer, Berlin, 1900; for a summary of all Seler's American travels, and a bibliography of his writings, see Festschrift Eduard Seler, edited by Walter Lehmann, VIII, 654 pp., illus. Stuttgart, 1922.

Approximately 90 collections of plants were made by the Selers in October and November (nos. 502–591). Numbers were assigned more or less chronologically, and most of the numbers were cited in the *Plantae Selerianae.* According to Loesener (Pl. Sel. 1. 1894) the principal sets of the collection of 1887–1888 became the property of the Berlin Herbarium.

Near the end of the expedition of 1895–1897 the Selers passed through Colima and again through a part of Jalisco. After completion of their work in Guatemala they left San José on March 2, 1897[1] and reached Manzanillo nine days later after a leisurely trip in a small coastal vessel. They made their way to Colima on the narrow-gauge railroad, which at that time followed the spit between the ocean and the Laguna de Cuyutlán almost to Armería before turning inland. They were forced to wait two days in Manzanillo because there were only three trains a week. In Colima they were assisted by the German consul, Arnold Vogel, who at the conclusion of their visit helped them to secure guide and horses for the two-day ride to Zapotlán. They took the usual route around the southeastern foothills of the volcano, passing through Quesería and Tonila probably April 4, and collecting in the Barranca de Tonila and Barranca de Beltrán on April 5. Not far beyond Tonila they were met by a wagon (for which they had arranged by telegraph) which took them the rest of the way to Zapotlán, where after a day's stopover they took the stage for the three-day ride to Guadalajara. Their trip ended with the train trip from Guadalajara to Irapuato and the overnight ride to Mexico.

The Colima and Jalisco collections, as far as known, include nos. 3424–3436. Numbers up to and including 3423 are from Guatemala, numbers 3438 and 3439 are from some unknown locality (Pl. seler. 98), and number 3440, from Ohio, begins the series collected during another and later expedition. According to Loesener (Pl. seler. 57–58) the principal sets of plants from Seler's second expedition went to Berlin, to Dr. Seler himself, and to New York.

Sessé y Lacasta, Martín de (ca 1750–1808). For the history of Sessé and the Royal Botanical Expedition to New Spain, the reader is referred to the detailed description by Harold W. Rickett,[2] or to more recent works based on additional study of archival materials in Spain.[3] The group headed by Don Martín de Sessé set out from Mexico City for "Mechoacan and Sonora" on May 17, 1790. The party included, in addition to Director Sessé, two artists, and two botanists, Juan de Castillo (1744–1793) and José Mariano Mociño (1757–1820). They travelled by way of San Juan del Río, Querétaro, Guanajuato, and Valladolid (now Morelia), which they reached early in August. They continued through Pátzcuaro and Uruapan, and went as far south as the still-active volcano of Jorullo, which had first erupted in 1759. They reached Apatzingán at least by the 20th of October, and made their base there for more than a month. The three-month period beginning with the arrival at Apatzingán was the most successful of the entire trip to western Mexico, from the standpoint of new species studied, described, and painted. More than 140 species, about half of them from Apatzingán and vicinity, are cited from southwestern Michoacán in the *Plantae Novae Hispaniae.*[4] About the end of November the party made plans to continue to

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[1]Cf. Chapter 12 (pp. 344–363; maps, pp. 356, 358) of Frau Seler's *Auf alten Wegen in Mexiko und Guatemala.*

[2]Chron. Bot. 11: 1–86. *pl. 44–52.* 1947.

[3]Wilson, Iris Higbie. Scientific Aspects of Spanish Exploration in New Spain during the late Eighteenth Century. pp. ii–x, 1–330. Ph.D. thesis, Univ. of S. Calif., 1962.

Arias Divito, Juan Carlos. Las expediciones científicas españolas durante el siglo XVIII. pp. 1–427. 59 plates. Ediciones Cultura Hispánica, Madrid. 1968.

[4]Sessé, M., and J. M. Mociño. Plantae Novae Hispaniae [Published in 9 parts as appendices to La Naturaleza, series 2, vol. 1]. pp. i–xiii, 1–184, index. 1887–1890. Second edition, revised and reset, pp. i–vii, 1–175, index. México, 1893.

the Pacific Coast, but on January 2, 1791, they had progressed no farther than Tepalcatepec, about 65 km west of Apatzingán. They had followed more or less the route of the modern highway, via San Juan de los Plátanos, Santa Ana Amatlán, and Buenavista Tomatlán.

From Tepalcatepec the Expedition crossed the divide into what is now Jalisco to the valley of the Río Ahuijullo, which they followed down toward Coahuayana. Even when travelling with pack-animals the botanists seem to have been impressed with the rough terrain, as there are several references in *Plantae Novae Hispaniae* to the "montibus inhospitalibus" between Tepalcatepec and Coahuayana. Evidently their stay near the coast was a profitable one, as more than 30 species are cited from Coahuayana and the nearby shores of the Pacific Ocean. Brand (1960, p. 221) seems to have been the first to use the *Plantae Novae Hispaniae* as a source of information about the itinerary of Sessé and Mociño and their party, by noting the species and their dates of flowering as given for each locality, and combining these data with those obtained by Rickett and others from archival sources.

After the party left Coahuayana they moved fairly rapidly for a time in February, probably passing Colima, Tonila (in the foothills of the Nevado de Colima), Zapotlán (today Ciudad Guzmán), Sayula, Lake Chapala. We do not know exactly when they reached Guadalajara, but it must have been just before the first of April. They stayed in Guadalajara about 4 months, organizing the materials they had gathered so far, and sending back to México, or even to Spain, whatever could be readied for the purpose. It was here that Mociño must have completed the manuscript of the *Plantae Novae Hispaniae,* which was forwarded to the Viceroy in México with a set of copies of the illustrations so far prepared by the artists Juan de la Cerda and Atanasio Echeverría.

Sometime between July 22 and August 13, 1791, the expedition travelled from Guadalajara to Tepic, more or less over the course of the modern highway at least as far as Ahuacatlán, Nayarit and then turning a little north of Cerro Sangangüey. After the departure from Guadalajara, there are of course no more helpful references in the *Plantae Novae Hispaniae.* In the other work attributed to Sessé and Mociño, the *Flora Mexicana,* there are occasional citations of localities in western Mexico, and among the manuscripts in the Instituto Botánico at Madrid is a stitched notebook of 32 pages that may be Sessé's original field-book (MA, 4ª Div., núm.2). The descriptions of plants in the latter seem to be roughly in chronological and geographical order from Guadalajara to Tepic and thence northward through Sinaloa.

For this part of the expedition, and indeed for the earlier part as well, the primary source of information has been the History section of the National Archives of Mexico—the *Archivo General de la Nación.* Specific dates and places in the travels of Sessé and Mociño have mostly been obtained from volumes 460, 462 (nos. 2, 3, 5), 464 (nos. 1, 4, 5), and 527 (nos. 7, 12, 13, 14).

After leaving Tepic, their route presumably followed the coastal lowlands through Nayarit and Sinaloa as far as Alamos, Sonora, where the entire party of scientists (consisting of Sessé, Mociño, Castillo, Echeverría and Cerda) drew their regular salary on October 21, 1791. On the way to Alamos from Tepic, judging from the entries in Sessé's notebook, they travelled through Ixcuintla, Paramita, Acaponeta, Rosario, Mazatlán, Piaxtla, Vinapa, Culiacán, and the settlement ["oppidum"] of Sinaloa. There is also a record in the *Archivo General* (AG, Hist. 527, pt. 7: 95) that all the above were present in the City of Durango on January 2, 1792, but nothing definite is known about their routes between Alamos and Durango. Sessé and Castillo, with one of the artists, returned to Mexico City before May 1, 1792, while Mociño, with the other artist, left San Blas in February 1792 with a Spanish naval expedition to the Pacific Northwest.

Table 1 lists the localities between Morelia and Tepic, as cited in the *Plantae Novae Hispaniae* and the *Flora Mexicana* of Sessé & Mociño. In these works the

TABLE 1. THE "THIRD EXCURSION," FROM MORELIA TO TEPIC, 1790–91

Dates and localities from *Plantae Novae Hispaniae* and *Flora Mexicana*

Locality	Number of Species Reported as Flowering																
	Jul	Aug	Aug & Sep	Sep	Oct	Nov	Dec	Dec & Jan	Jan	Feb	Mar	Apr	May	Jun	Jun & Jul	Jul	No date given
Patzcuaro, [Mich.]		15	2	2													2
Tingambato, [Mich.]				2													
Uruapan, [Mich.]		1		8	1												2
Ario, [Mich.]	1			5													
Xorullo (or Jorullo), [Mich.]		2		7													2
Apatzingán, [Mich.]	1	4		8	41	7	3										6
S. Juan de los Plátanos, [Mich.]					7		1										
Sta. Ana Amatlán, [Mich.]							2										
Tepalcatepec, [Mich.]					1	1	5		1								
Ahuejuyo, [Jal.]						2	6		2								
Between Tepalcatepec and Coahuayana							7		5								
Chacalapa, [Mich.] near Coahuayana									1								
Coahuayana, [Mich.]				4	3	6	2		9		1						6
Colima, [Col.]						1				4							
Tonila, [Jal.]										2							
"Ad margines rivulorum ex Colimense vulcano effluentium"										1							
Zapotlán, [Jal.]										3							
Sayula, [Jal.]								1		3							
Lake Chapala, [Jal.]										1							1
Chapala, [Jal.]										1							2
Guadalaxara and vicinity, [Jal.]											3	4	2	4		4	3
Amatitán (or Amatitlán), [Jal.]													1			2	
Hostotipaquillo (or Hostitipaquillo, or "S. Thoma near Hostotipaquillo), [Jal.]												1		1	1	1	
Tequila, [Jal.]														1		2	
Tepic, [Nay.]																	1 [also 1 Jan]

authors customarily cited the date of flowering of each species, and mentioned the locality (or sometimes several localities) from which they knew it. By assembling the data in chronological order it is possible to follow their route through Nueva Galicia with some assurance, and to estimate the length of their stay in each place. Published dates of flowering are to be interpreted with caution, as in some instances the period of flowering seems to have been inferred from study of fruiting specimens; in at least one instance the authors specifically state that they had done just this.

Approximately 50 species, mostly said to flower in October, are cited in the works of Sessé & Mociño as from Ahualulco. This is apparently not the place of that name in Jalisco, as supposed by Sprague,[1] but a place with a warmer, wetter climate, perhaps in southeastern Mexico. The list of species from Ahualulco includes several which seem out of place on the plains west of Guadalajara, including three species of *Heliconia,* thirteen species of *Melastoma,* four of *Piper,* and others. A species of *Cynanchum* and one of *Solanum,* newly described as from Ahualulco, are given the specific epithet *tabascense,* which would suggest that their geographical source was in the lowlands somewhere southeast of Mexico City. I have not located any place of this name in Tabasco or adjoining Veracruz, but Mociño worked in southern Veracruz and perhaps in Tabasco also during the last few months of 1794, and it seems likely that the locality was somewhere in this region.

The one species, *Geum resinosum,* which is reported to flower at San Juan de los Lagos in February, may have been noted by Mociño as he passed through after leaving Aguascalientes (cf. Rickett's account, p. 29) on his way to join the Nutka Expedition or, more probably because of the dates involved, on his way back to México after he disembarked at San Blas on February 3, 1793.

The rebellious Naturalist of the Royal Botanical Expedition, José Longinos Martínez, passed through Jalisco on his way to San Blas, having left México in January 1791; it is possible but unlikely that he was the author of the report of *Geum resinosum* from San Juan de los Lagos; his primary interest was zoological rather than botanical, and he is not known to have collected many plants. The Sessé & Mociño collection in Madrid includes 2 specimens (out of about 8000 in all) known to be labelled in the writing of Longinos. Longinos spent a considerable amount of time in the exploration of southern Nayarit before going on to Baja California, and then again after his return from Upper California in November 1792. He made some botanical observations, and even compiled a list of trees of San Blas, but the fate of his collections is unknown. His journals of 1791–1792, recently newly translated and edited by Simpson,[2] include many interesting descriptive notes on the route between Mexico City and San Blas, and on other localities in southern Nayarit.

The botanical results of the so-called "Third Excursion," which effectively terminated in Guadalajara or perhaps in Tepic in the summer of 1791, were considerable, although neither the number of specimens collected nor the number of *icones* was as large as the corresponding number on the "Second Excursion" [that to Acapulco in 1789], because the botanists were becoming more selective and were not finding as many species new to them. On the excursion of 1790–1791, they assembled slightly more than 100 paintings, and herbarium collections to the number of 172; the latter, including all those sent back to Mexico before July 1791, are listed by Alvarez López (An. Inst. Bot. Cav. 11, pt. 1: 125–141. 1953). The most important result of the excursion was the completion of the manuscript of the *Plantae Novae Hispaniae,* without which we should be lacking much of the information we now have about the

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[1]Sprague, T. A. Sessé and Mociño's Plantae Novae Hispaniae and Flora Mexicana. Kew Bull. 1926: 417–425. 1926 [Sessé and Mociño's Mexican localities, pp. 422–424].

[2]Simpson, Lesley Byrd. Journal of José Longinos Martinez. i–xvii, 114 pp. maps. John Howell–Books, San Francisco, 1961.

early botanical activities of the Expedición Botánica, and about the organization and identification of the paintings made during the early years of the expedition (the "Icones Florae Mexicanae").

Because the manuscript descriptions written by Sessé and Mociño were not published for a century after they were written, most of the new names published in 1887–1894 in the *Plantae Novae Hispaniae* and in the *Flora Mexicana* are later synonyms. It cannot automatically be assumed, however, that a name published by Sessé & Mociño is not the oldest available one for a species. This is particularly true for species from western Mexico, where there is much local endemism and where many species discovered by the party of 1790–1791 were not again noted by botanists until very recently.

More than 200 species were definitely reported, in the works written by Sessé and Mociño themselves, from within or near the boundaries of Nueva Galicia. Perhaps half of these were described as new, and 60 or more of these bear names that appear to be valid and tenable even though delayed a century in publication.

Identification of the new species described in the *Plantae Novae Hispaniae* and the *Flora Mexicana* is not always easy. The original specimens, in the herbarium of Sessé and Mociño at Madrid (MA), usually lack identifying data except for the binomial conferred on the species. When a given binomial in one of the floras can be matched with the same name on a specimen, or on one of the *icones,* positive identification is sometimes possible. Duplicate specimens, usually bearing the original binomials proposed by Sessé and Mociño, were somewhat widely distributed through the larger European herbaria before 1850, and often these can be identified by their names as belonging to the original collections, even though they lack locality data.

As examples of the method of identification of species published in the *Plantae Novae Hispaniae,* the following will suffice:

Saurauja serrata DC. (DC. Mém. Soc. Phys. Hist. Nat. Genève 1: 420. *pl. 3.*1822) was long unidentifiable because it was based wholly on one of the paintings made by the artists of the Sessé and Mociño expedition; DeCandolle knew only that it was painted in Mexico and, as no known specimens existed, no botanist after DeCandolle knew the source of the painting of the identity of the plant depicted in it. DeCandolle's published plate proves to be an exact copy of a plate at Madrid, this labelled in a contemporary hand with the name *Coriaria cuneifolia. Coriaria cuneifolia* Sessé & Mociño (Pl. Nov. Hisp. 173. 1890, with type-locality near Uruapan, Michoacán), is from the description presumably *Saurauia,* and evidently the common species of its genus in western Mexico, the one called most recently *S. reticulata* Rose (1903).

Melochia rotundifolia Sessé & Moc. Pl. Nov. Hisp. 106. 1889, with type-locality Chilpancingo, Guerrero, is evidently the same as *Pterostemon mexicanus* S. Schauer (1847). Ic. Fl. Mex. 296, cited in the protologue of *M. rotundifolia,* exists in the form of an original painting in the collection of DeCandolle (his no. 93*, also bearing the number "296"); the plant depicted is evidently *P. mexicanus;* furthermore specimens of the same species, labelled as *Melochia rotundifolia,* exist in the Sessé & Mociño herbarium at Madrid, and in the British Museum, among specimens sold to A. B. Lambert by Pavón.

Schinus angustifolius Sessé & Moc. Pl. Nov. Hisp. 173. 1890, with type-locality near Ixtla, Guanajuato, not represented in the Sessé & Mociño herbarium, was thought from the description to be a synonym of *Bursera galeottiana* Engl. (1881). On a visit to the type-locality, not far from the City of Querétaro, Prof. Jerzy Rzedowski confirmed this tentative identification by re-collecting the same plant, still known locally as "xixote colorado," as reported by Sessé & Mociño.

Spilanthus [sic] *corymbosus* Sessé & Moc. Pl. Nov. Hisp. 129. 1889, with type-locality Querétaro, is recognizable from the description as a species of *Verbesina,*

perhaps *V. serrata* Cav. (1795). This tentative identification is confirmed by a specimen in the Sessé & Mociño herbarium, labelled as a *Verbesina*, but with the epithet "corymbosus."

A definitive summary and evaluation of the botanical work of the Royal Botanical Expedition to New Spain remains to be written. Because of the uncontrolled dispersal of the original herbarium materials and the paintings assembled by the Expedition, and the inability of Sessé and his associates to publish the *Flora Mexicana* under the conditions prevailing in Europe at the time of his return (1803–1804), much valuable information was lost. During the 19th Century botanists in Europe published several hundred new species based on the Sessé & Mociño specimens, and even on the paintings in the absence of specimens. The authors of such new taxa were often unaware of the exact geographical source of their material, and as often ignorant of the name of the collector of the type-specimen. From the standpoint of the *Flora Novo-Galiciana,* this means that every new species described by Sessé & Mociño has to be investigated on its own merits, and compared with other species that may have been published and based on the *Icones Florae Mexicanae,* or based on specimens attributed to Sessé and Mociño, or even on specimens from Mexico or "New Spain" attributed to Pavón.

Shaw, George Russell (1848–1937). Shaw, the author of *The Pines of Mexico,*[1] travelled with C. G. Pringle during the season of 1904, to study his specialty, the genus *Pinus.* With Pringle he came by train to Guadalajara on October 21, and to Etzatlán late the night of the following day. On the 23rd, according to Pringle's account (Davis, p. 223), they followed the "steep tortuous cart road up and over the mountain summits nearly to the Santo Domingo mines, then . . . on to the Mesa Colorado to the south." Here they were pleased to find *Pinus lumholtzii.* They returned to Guadalajara on October 25, and on the 26th took train for Zapotlán, where Shaw wished to study the native pines.

Shaw's specimens of the genus *Pinus* were not widely distributed. A large set, originally from the herbarium of H. H. Bartlett, is at the University of Michigan (MICH). A complete collection is maintained separately at the Arnold Aboretum of Harvard University (A).

Sheldon, Mrs. D. Henry. The herbarium of the Field Museum (F) contains approximately 177 specimens, collected in Jalisco by Mrs. Sheldon in 1892–93. These were originally a part of the herbarium of the University of Chicago, and are listed in the Accession records of the Museum, volume 53, pp. 83–87, under nos. 354580–354756. Mrs. Sheldon appears to have lived in Guadalajara from about mid-August, 1892, until the following spring. The earliest collection I have seen is from Agua Azul (Guadalajara), August 18 (*Sagittaria variabilis*), and the latest is from Guadalajara, March 1893 (*Philadelphus* sp.). Most of the collections appear to be from the immediate vicinity of Guadalajara (e.g. Agua Azul, Atemajac, Barranca de Ibarra); a considerable number are from Chapala and vicinity ("Island in Lake Chapala," or "San Antonio, Lake Chapala"), and at least one collection is labelled as from Mascota (*Rondeletia langlassei,* January 7, 1893). The locality which has been cited in literature as "San Antonia" is clearly written "San Antonio" in several places in the Sheldon lists; presumably this is San Antonio Tlayacapán, between Chapala and Ajijic. I have not been able to learn anything more about this collector or her work in Mexico.

The labels attached to Mrs. Sheldon's collections are hand-written and the collector's name does not appear on the label; in case of doubt reference may be made to the accession records where the species are listed by name. One of the species, *Cosmos crithmifolius,* collected September 6, 1892, was cited by Sherff, who suggested

[1] Arnold Arb. Publ. 1: [i–iv], 1–29, index; *pl. 1–22.* 1909.

that the collector might have been Edward Palmer.[1] From the locality and data, however, it seems apparent that the collector was Mrs. Sheldon. Palmer did not collect in the vicinity of Guadalajara except in 1886.

Shreve, Forrest (1878–1950). As part of his longtime study of the North American deserts, Shreve travelled and collected briefly in Aguascalientes, northern Jalisco and southern Zacatecas, in 1938 and 1939. His specimens and notebooks are at the University of Arizona, Tucson (ARIZ). I am indebted to Dr. Charles T. Mason, Jr., for much of the following information.

On September 7, 1938, Shreve drove from the City of Zacatecas via Noria Los Angeles to Pinos, Zacatecas, and thence the next day to San Luis Potosí. In the hills west of Pinos and 7–17 miles south and southeast of that place he collected nos. 8658–8684. In 1939 he came into Aguascalientes from the north. He camped August 29 in a close stand of *Prosopis, Acacia, Opuntia* and *Lippia,* 11 miles [ca. 18 km] north of Rincón de Romos and the next day collected nos. 9221–9246. Continuing on August 30, he passed Rincón de Romos (nos. 9247–9248a), drove by way of Pabellón to beyond Presa Calles, where he collected nos. 9249–9271, at elevations of about 2200 m ("7300 to 7400 feet"). Near the dam at "7000 feet" he collected nos. 9272–9279 on August 31. On the same day he took nos. 9280–9283 (8 km east of Aguascalientes). Continuing on the road to Ojuelos he passed La Punta (ca 11 km east of the Jalisco-Aguascalientes border) and camped 8 km further on [Here he was 5 km or a little more north of the present highway]. On September 1 he collected nos. 9284–9296 near La Punta and east of the place, 9297–9299 near Chinampas, 9300–9301 near Ojuelos.

Sinclair, Andrew (–1861). In the final fascicles of the *Botany of Captain Beechey's Voyage,* Hooker and Arnott[2] described a collection made in December, 1837, "at San Blas, or between San Blas and Tepic," by Dr. Andrew Sinclair, "Surgeon of H. M. surveying Ship, Sulphur." Sinclair's collection, as listed, consisted of about 72 species, of which 17 were described as new; part of the collection was left unlisted because of lack of space in the final fascicle (Hooker & Arnott, p. 433). A number of the novelties not described in the *Botany of Captain Beechey's Voyage,* however, were published by Bentham a few years later in the *Botany of the Voyage of H. M. S. Sulphur* (for full citation of this work see above under Hinds). The number of specimens gathered by Sinclair in Mexico may have been well over a hundred. Bentham noted that "A considerable portion of the specimens described from Western Tropical America [in the "Botany of the Sulphur"], were gathered by Dr. Sinclair, and presented by him to Sir William Hooker, in whose herbarium the originals of these species will be found." Sinclair's name, however, does not accompany the mention of individual species in the text, so that for specimens attributed to Tepic or San Blas the collector's name can be ascertained only by reference to the actual specimen in the herbarium of Hooker or in some cases that of Bentham. The locality given in the text for *Crusea lucida* Benth., for example, is merely "Southern Mexico" and no collector's name is cited; on the type-sheet in Hooker's herbarium the locality is given as "Mexico," and the collector as Sinclair.

Dates of individual collections are not given in the "Botany of the Sulphur"; there is nothing more than a general statement that the work took place "Between the years 1836 and 1839." The herbarium specimens at Kew are likewise undated. Sinclair presumably collected when the "Sulphur" was in port and when his duties permitted him to leave the ship. The movements of the "Sulphur" are described by Barclay

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[1] Field Mus. Publ. Bot. 8: 427. 1932.
[2] Bot. Beech. Voy. 410–444. 1840–1841.

(q.v.), who also mentions a trip from San Blas to Tepic with Dr. Sinclair, December 26, 1837 to January 3, 1838.

Soderstrom, Thomas R. See King.

Sooby, Joseph, Jr. See McVaugh (1952).

Souviron, Max J. See Erlanson, and Russell.

Stadden, ————. The Herbarium of the United States National Arboretum, according to Killip,[1] contains a specimen of *Passiflora ligularis,* collected at Manzanillo by Stadden in 1911. Possibly this is the same Stadden whose ranch near Manzanillo was visited by Marcus E. Jones, June 24–26, 1892.

Stanford, L. R. See Hitchcock, C. Leo.

Stevens, Warren Douglas. See McVaugh (1970).

Stork, H. E. See California, University of.

Straw, Richard Myron. In connection with revisionary studies on the genus *Penstemon,* Professor Straw of Los Angeles State College, California, travelled widely in Mexico in the years between 1957 and 1960. In 1957, assisted by David P. Gregory, he collected in Jalisco, and in 1958, assisted by Michael Forman, he collected in Aguascalientes and northern Jalisco. His specimens were distributed especially to Rancho Santa Ana Botanic Graden (RSA), the University of Michigan (MICH), and the Instituto de Biología, Mexico (MEXU).

Thibaud, H. It may be inferred from the wording of the protologue of *Cissampelos heterophylla* DC. (Syst. 1: 534. 1818) that the type was collected at San Blas, "Nova Hispania," by Thibaud. Presumably this is the same Thibaud who contributed 1200 specimens to the DeCandolle herbarium (A. DeCandolle, Phytographie 454. 1880), but it is unlikely that he was the collector of this particular specimen. Not to be confused with Lieutenant Thiebaut, who at a much later date collected at Acapulco according to Hemsley (Biol. Cent. Am. Bot. 4: 136. 1887). Brand (1960, p. 226) states that Lt. Thiebaut collected at Manzanillo while a member of the French Mission Scientifique of 1865–66, but I have never seen any other evidence of this.

Thiebaut, Lieutenant. See Thibaud.

Torres, Andrew Marion. Professor Torres, now of the University of Kansas, travelled in Mexico to collect material for revisions of *Zinnia* and other genera of Compositae. He collected a few specimens in Jalisco (cf. Brittonia 16: 425. 1964); the first set of these is at the University of Wisconsin at Milwaukee (UWM).

Trelease, William (1857–1945). Trelease, while engaged in the study of Yuccas, agaves, and other plants, visited Jalisco several times, and some of his collections and observations have been recorded in the literature. In September 1901 he visited Zapotlán to observe and photograph the plants which he subsequently described as *Yucca schottii jaliscensis.*[2] In the same year he visited La Barca, at the east end of Lake Chapala.[3]

In 1903, and again in 1904, Trelease returned to the vicinity of Guadalajara, this time more particularly concerned with the study of *Agave.* Some new species were described from his collections; the types are in the Missouri Botanical Garden (MO).

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[1] Field Mus. Publ. Bot. 19: 345. 1938.
[2] Rep. Missouri Bot. Gard. 13: 99–100, 127, *pl. 56.* 1902.
[3] Contr. U.S. Nat. Herb. 23: 114, 116, 132. 1920.

Turner, Billie Lee. Professor Turner, now of the University of Texas, in the summer of 1950 was one of a group that visited Michoacán and Colima, under the leadership of Donald D. Brand, for geographical and biological studies. Turner, the only botanist on the trip, collected plants to the extent of about 327 numbers. The first set of these is deposited at Southern Methodist University (SMU); a second set is at the University of Michgian (MICH). After collecting (nos. 1861–1952) in Michoacán, chiefly in the vicinity of Volcán Paricutín, near Uruapan, in and about La Playa (18 miles south of Ario de Rosales), and in the vicinity of Volcán Jorullo, Turner travelled by bus and train from Ario to Guadalajara and thence to Colima, June 20–21. He collected nos. 1953–1965 near Colima, June 22; travelled to Coahuayana, Michoacán, by truck (June 24) and collected at Coahuayana nos. 1966–1996 (June 25); travelled to the mouth of Río Coahuayana by truck and collected there nos. 1997–2002 (June 26); at the same locality and at Ojos de Agua collected nos. 2003–2013, 2036–2037 (June 27–29). On June 30 he walked with a pack-train to La Placita; he collected in this locality nos. 2014–2035, 2038–2153 (July 1–12). On July 13 he walked and rode horseback to Ostula, where he collected nos. 2154–2186 (July 14–16).

Turner's report on the flora and vegetation was published by Brand.[1]

Uhde, ————————. In *Das Pflanzenreich* IV. 83 (Heft 39): 103. 1909, under *Rivina humilis,* there is a report of this species from Tonila, Jalisco, the collection by Uhde (no. 177). This report has not been verified and seems doubtful. C. A. Uhde, who was Prussian consul at Matamoros about 1845,[2] made large collections in eastern Mexico. I have not seen other reports of his having worked in Jalisco.

Velasco, José. See McVaugh (1959, 1960).

Viereck, H. W. The United States National Herbarium (US) has a series of collections made by Viereck in May 1931, including all or a part of his series at least from 1159 to 1320. The localities as far as noted are all near the railroad, between Tepic and Guadalajara: Tepic, Ixtlán, Magdalena. The specimens from Nayarit and Jalisco form part of a series of about 600 Mexican plants collected by Viereck, received in exchange from the Botanisches Museum, Berlin, in 1936. I know nothing further about the collector, or about the circumstances under which the plants were collected.

Wagner, Helmuth O. See McVaugh (1949).

Waterfall, Umaldy Theodore (1910–1971). Professor Waterfall, of Oklahoma State University, travelled in Mexico on several occasions, primarily to collect material for a revision of the genus *Physalis,* but also to make general collections. He collected in Nueva Galicia at least in 1957, 1959, and 1961. His specimens are in the herbarium of the University, at Stillwater, Oklahoma (OKLA), and duplicates have been distributed.

Weber, Frédéric Albert (1830–1903). Weber was a French physician who collected plants, particularly cacti, while attached to the marching columns of the French expeditionary forces in Mexico about 1865.[3] He is stated to have collected specimens of *Cereus tetazo,* including the type, at Zapatalan (i.e. Zapotlán?), Jalisco in 1864 and

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[1] Turner, Billie L. Phytogeographic Reconnaissance: The western segment of the Michoacán coast. In Brand, 1960, pp. 272–286. See also the fuller report on the work of the University of Texas' field party of 1950, in Brand, 1960, pp. 3–34.

[2] Cf. Standley in Contr. U.S. Nat. Herb. 23: 155. 1920.

[3] Hemsley, in Biol. Centr. Am. Bot. 4: 136. 1887.

1869. Many of his specimens and extensive notes on cacti were given to George Engelmann in 1869 and are now in the Missouri Botanical Garden (MO).[1]

In Weber's later years he maintained a strong interest in cacti and other succulents, and published several papers based primarily upon materials collected in Jalisco and elsewhere in Mexico by Léon Diguet (e.g. an article on *Agave* which included the first botanical description of *A. tequilana,* the commercial source of tequila.[2] After his death his existing notes and other botanical materials became the property of the Muséum National d'Histoire Naturelle, Paris, and some species which he had in manuscript were published posthumously, edited by Rolland Gosselin. This included species noted by Weber during his own Mexican travels, and some collected by Diguet and others.[3]

Weber, William Alfred. Professor Weber of the University of Colorado, and Leopold Charette of the University of Vermont, travelled through Nayarit and Jalisco in 1962, and collected numerous herbarium specimens, of which a partial set is at the University of Michigan (MICH).

Webster, Grady Linder. Professor Webster of the University of California at Davis has collected Euphorbiaceae and other things in Mexico on several occasions in recent years. In 1970 he visited the Cerro de Tequila and other localities in western Jalisco. See also Rowell.

Weintraub, Frances C., and **Jane Roller.** About 204 numbers, including some duplicates, were obtained by these collectors in Jalisco in July, 1955. Most of the specimens came from localities near the highways leading from Guadalajara to Jiquilpan, Michoacán, to San Luis Potosí, or to Yahualica. The principal sets of the collection were presented by Mrs. Weintraub to the University of Michigan (MICH) and to the Instituto de Biología, Universidad Nacional, México (MEXU). Following is the list of collections:

Five miles northeast of Ojuelos de Jalisco, July 19 (nos. 1–20); 1–4.5 miles south of Ojuelos, July 19 (21–74); 27 miles east [i.e. northeast] of Lagos de Moreno, July 20 (75–94); east [northeast] of Lagos at Km. 230, July 20 (95–102); edge of barranca near Guadalajara (vicinity of Huentitán), July 21 (103–117); hilltop overlooking Yahualica, July 22 (118–141); near bridge 17 miles from Yahualica, July 22 (142–155); east of Guadalajara, July 22, between Km. 28 and 29 (156–160), between Km. 20 and 21 (161–162); along road from Guadalajara to Jiquilpan, July 24, 11 miles from Guadalajara (163–171); Km. 646–647 (172–173); at junction with road to Autlán (174–175); marshy roadside 7 miles south of Autlán junction, Km. 635 (176–186); Km. 630 (187–196); Km. 617 (197–199); Km. 610 (200); Km. 560, near border of Jalisco and Michoacán (201–204).

West, James. See California, University of.

Westlund, B. L. See Rowell.

Wilbur, Robert Lynch. See McVaugh (1949). After Wilbur and I returned from Mexico to Ann Arbor, Michigan, early in June, 1949, he returned to Jalisco almost at once, with the aid of a grant from the Botanical Gardens, University of Michigan. He was accompanied by his brother, C. R. Wilbur, and by Howard A. Crum. Crum and Robert Wilbur were both at that time graduate students at the University. Crum's interest was in bryophytes, of which he obtained 998 specimens, and the Wilburs concentrated on the collection of vascular plants, of which they obtained approximately 1100 numbers (1372–2479) in sets from 1 to 7 or more. The work of the party, which was centered about Autlán, began June 25 and continued until August 24.

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[1] Coulter, Contr. U.S. Nat. Herb. 3: 382. 1896.
[2] Bull. Mus. Paris 8: 220. 1902.
[3] Bull. Mus. Par. 10: 382. 1904; op. cit. 11: 508. 1905.

Principal collecting areas were in the mountains and lowlands southwest of Autlán, between that place and La Resolana, June 28–July 2 (1392–1481), July 5–10 (1499–1642), July 15 (1719–1762), August 5–9 (2117–2205), August 11–15 (2241–2372), August 18–20 (2390–2465). Various areas, both on the moist seaward slopes and the more arid landward side, were explored thoroughly in trips out of Autlán.

After the middle of July several days were taken up with getting to El Chante and making arrangements for pack animals to take the party into the Sierra de Manantlán, to the base-camp which Robert Wilbur had visited earlier in the year; the trip beyond El Chante occupied approximately two days. Collections were made along the way, July 22 (1763–1787), and in the mountains, July 23–31 (1788–2017). The expedition returned to Autlán on July 31, Wilbur collecting nos. 2018–2116 along the way.

This is the largest and best summer collection ever made in Jalisco, and when it has been fully studied it will no doubt prove to be one of the most interesting because the area from which it came is still relatively little-known. The first sets of the collection are at the University of Michigan (MICH), and at the Instituto de Biología, Mexico (MEXU).

Windler, Donald R. Windler travelled in Mexico in 1967, primarily to collect material for revisions of *Neptunia* and allied groups. He made some collections in Nueva Galicia.

Wood, Arthur. See Fernow.

Wood, Carroll E., Jr. See Moore.

Woods, ————————. Reported by Trelease to have collected *Quercus candicans* at Colima, in March 1910. Presumably this is the "Arthur Wood of Colima" to whom Fernow wrote concerning a private forestry venture, on November 26, 1909, but nothing further about him has been learned.[1]

Worth, Carleton R. See California, University of.

Wright, William Greenwood (ca 1830–1912). Wright, who was known to biologists chiefly for his work on butterflies,[2] travelled in western Mexico in the winter of 1888–1889, and published a series of travel-notes.[3] He collected for several days in the vicinity of San Blas in January, 1889, and made several excursions along different roads towards the foothills in the direction of Tepic. His plant-specimens, serially numbered (from 1331 to 1351 have been seen), were distributed in several sets with a printed label headed "San Blas and vicinity, Jan. 1889."

Xántus, János (1825–1894). A Hungarian naturalist who had already had much experience on the Pacific Coast of Mexico, Xántus was appointed American Consul at Manzanillo in November 1862. He reached Manzanillo, by boat from Panama, on December 28 of the same year. His commission was revoked about six months later, but he remained at Manzanillo until early in March, 1864.[4]

The work of Xántus in Colima was relatively unimportant in the field of Botany. Madden (op. cit. p. 291) did not locate any reference to species of plants new to science discovered by Xántus in Colima. Apparently he collected relatively few plants,

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[1]Mem. Nat. Acad. Sci. 20: 204. 1924; Rodgers, Andrew Denny, III. Bernhard Eduard Fernow. p. 463. 1951.

[2]Essig, E. O. A history of entomology. pp. 802–804. 1931.

[3]Wright, W. G. Mexican notes. I. Zoe 1: 51–54; idem, II. op. cit. 102–106; idem, III. op. cit. 212–219; idem, IV. op. cit. 231–235. 1890.

[4]Madden, Henry Miller. Xántus, Hungarian Naturalist in the Pioneer West. Linz, 1949. Chapter 6, Manzanillo and Colima, 1863–1864, pp. 171–201.

although his activity in zoological collecting was considerable. From his bases at Manzanillo, and Colima, according to Madden, Xántus made various trips within a radius of about 50 miles. In March, 1863, he went along the coast about 40 miles south of the mouth of the Río de la Armería; in August he visited Tonila and Zapotlán in Jalisco; and in December of the same year he scouted into Michoacán (Madden, op. cit. p. 190). James A. Peters[1] discusses the zoological work of Xántus, including a trip into southwestern Michoacán, when Xántus left Colima April 5, and returned May 10, 1863, after a 16-day trip up the coast from La Orilla to Manzanillo.

The plants which Xántus is actually known to have collected, at Fort Tejon, California and at Cape San Lucas, Baja California, were reported upon mostly by Asa Gray (see Madden, op. cit., pp. 262, 263, 286–288), and are mostly to be found in the Gray Herbarium (GH) or in the United States National Herbarium (US). These herbaria are known to contain at least a few plants collected by Xántus at Manzanillo (e.g. *Kallstroemia grandiflora, Galeana hastata, Melampodium americanum,* and *Pectis uniaristata*).

Zingg, Robert M. This investigator, an ethnobotanist attached at that time to the staff of the University of Chicago, carried on some investigations from 1933 to 1935 in the country of the Huichol Indians of northern Jalisco, and collected some plants, which are in the Herbarium of the Field Museum, Chicago (F).[2]

Zorrilla, G. See McVaugh (1952).

Zorrilla, S. See McVaugh (1952).

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[1] In Brand, 1960, pp. 322–324.

[2] Cf. "mts. near Bolaños, 6000–8000 ft., 1935, *R. M. Zingg,* no. 21." Contr. Gray Herb. II, 155: 12. 1945.

Part II. Gazetteer

The following alphabetical list is intended to include the names of all localities in Nueva Galicia from which plants have been collected, as far as these are known to me through herbarium specimens I have examined, or specimens that have been cited in botanical literature. It is thought to be reasonably complete for the period 1790–1940. For the period after 1940, with increasingly easy access to almost all parts of the region, and correspondingly great increase in the number of collectors who took a few specimens here and there along the highways or at airports, I cannot pretend to any degree of completeness. In recent years, also, many botanists and others have visited Nueva Galicia more or less incidentally, in connection with their work on special groups of animals or plants, in connection with student tours from colleges and universities, in the course of ethnobotanical studies, or on vacation trips. Many of the specimens they collect go into personal herbaria or into small institutional herbaria where they are not likely to be found by students of the Mexican flora. Collectors who specialize in certain groups of plants often seek for and find specimens in localities where few general collections have been made. The following list is based primarily on references obtained from a general survey of literature and from study of the itineraries of known collectors, and secondarily on data obtained from specimens of Compositae, Burseraceae, Euphorbiaceae, Fagaceae and a few smaller families that have been studied in detail for the *Flora Novo-Galiciana.* As more and more families are studied in the same detail, additional localities are sure to come to light.

In the list the name of each locality is followed by the name of the State (Estado) in which it is located (if this is known), then by the names (in parentheses) of the principal collectors who are known to have worked at the locality. Such persons are mentioned if they are reported to have visited the locality, even if the reports are now known to be erroneous.

The geographical position of each locality is indicated, if possible, by reference to the "Map of Hispanic America at 1:1,000,000," the "Millionth Map" of the American Geographical Society of New York. In 1950–1955, when the compilation of this gazetteer was begun, the Millionth Map was by far the best available general source of information about localities in Nueva Galicia, and it had the additional advantage of a complete, separately published index in book form. The sheets pertaining to Nueva Galicia were still available from the publishers in 1971, and although several recent Mexican maps are more detailed or in some respects more accurate, none is so generally accessible or so well indexed. It was therefore decided to use the Millionth Map as a standard whenever possible. If a locality in the present list is shown on the Millionth Map, this is indicated by the letters AGS. When the name of the locality is spelled one way on AGS and another in the index to the map, this is indicated in the text.

The approximate geographical position is given for each locality. Whenever possible the latitude and longitude are given exactly as in the Index to the Millionth Map, i.e. to the nearest degree, and the position further indicated by a letter (a, b, c, or d) showing that the place in question is, respectively, NW, NE, SW or SE of the point where the parallel and the meridian intersect. Thus in Jalisco there are several places called Santa Cruz; the one at which Marcus Jones collected is listed below as Santa Cruz, 20-104c (i.e. it is southwest of the point on the map where the lines marking 20° North Latitude and 104° West Longitude intersect). Bárcena's locality of the same name, on the other hand, is listed as Santa Cruz, 21-104c.

Places not listed on the American Geographical Society's map have been located on other maps whenever possible, or by reference to some other well known fixed place. The principal maps used are the Carta Geográfica de la República Mexicana (cited as CARTA), published in 1956–1958; the earlier, provisional edition of the same map (also cited as CARTA, but with the date of publication, 1949); the Atlas Geográfico de la República Mexicana (1943–1944, cited as ATLAS), and an unpublished map of Jalisco (cited as Jalisco 1:100,000). There are also a few citations from the map of Aguascalientes at 1:100,000, in the Atlas Geográfico of 1963. Complete references to these maps may be found in the bibliography at the end of this paper.

Additional information about collectors and localities, itineraries, and collections, may often be found in the text of the first part of this account, in the sketches of the work of individual collectors. Isolated records from the literature are cited in full in the body of the list below, but for works to which reference is made many times (e.g. Davis, 1936; Goldman, 1951, Martínez, 1948; Urbina, 1897) the reader should consult the bibliography.

No attempt has been made to cite the place of publication of all mis-spellings and corruptions of geographical names, but these have been included in the index as noted, with appropriate cross-references.

Acahuato, Michoacán (Leavenworth & Hoogstraal). AGS, 19-102a.

Acatlán de Juárez, Jalisco (McVaugh). AGS, 20-104b.

Acayapa, Nayarit (Mexia). Near Tepic, q.v.

Adobes, Los, Rancho, Aguascalientes (McVaugh & Koelz). Adobes of ATLAS, Edo. de Aguascalientes 1:200,000, ed. of 1934, corr. 1961. South of Calvillo, at the foot of Sierra del Laurel.

Agua Azul, Jalisco (Bárcena, Jouy, Pringle, Sheldon). The site of a park near the southern edge of the city of Guadalajara, at about the end of the Calzada de Independencia. Jouy collected birds here. Said by Davis (1936, pp. 141, 705) to be a park "near Guadalajara."

Agua Blanca, Jalisco (McVaugh). The site of a sawmill about 12 km north or northeast of Santa Mónica, q.v.

Agua del Obispo, Jalisco (Moore & Wood). AGS, 21-102a. See Lagos de Moreno.

Aguacate, Nayarit (Rose). See Goldman (1951, p. 202). Also spelled Aguacata.

Aguacates, Los, Nayarit (Mexia). AGS, 21-105b. See Tepic.

Aguacatlán, Nayarit (Gregg). Ahuacatlán of AGS, 21-104a.

Aguascalientes, Aguascalientes (Griffiths, Hartweg, Hitchcock, McVaugh, Rose). AGS, 22-102c.

Aguililla, Michoacán (Hinton). AGS, 19-103d.

Ahuacapán, Jalisco (McVaugh & Koelz). AGS, 20-104c.

Ahualulco, Jalisco (Bárcena, Oliva). Ahualulco de Mercado of AGS, 21-104d. About 90 species are reported by Urbina (1897), on the basis of collections made by Bárcena, from "Valle de Ahualulco," from "Santa Cruz, Valle de Ahualulco" or from "Cerro de Santa Cruz, Valle de Ahualulco." Santa Cruz (AGS, 21-104c) is about 6 km south-southwest of Ahualulco. Sessé and Mociño reported about 50 species from Ahualulco, and Sprague (Kew Bull. 1926: 423. 1926) supposed that this was a locality in Jalisco. This is apparently not the case; see text above, page 308.

Ahuijuyo, Jalisco (Sessé & Mociño). AGS, Index p. 14 (Ahuijullo of AGS, 19–103a). Also spelled Ahuejuyo, Ahueiuyo, Ahuehuio, Ahuesuyo.

Alo, Sierra del, Jalisco (Diguet). See Sierra del Halo.

Altanquillo, Altenguilla. See Atenguillo.

Alzada, Colima (Hitchcock, Orcutt). AGS, 19-104b.

Amacueca, Jalisco (McVaugh). AGS, 20-104b.

Amatanejo, Jalisco (Hartweg). Not located on a map, but nearly south of Compostela, Nayarit, just south of the Río de Ameca. Called by Hartweg Matanejo.

Amatitán, Jalisco (Gregg, McVaugh, Moore & Wood). AGS, between Arenal and Tequila. Also spelled Amatitlán. Sessé and Mociño cited specimens from a place called Amatitán or Amatitlán, which presumably was Gregg's locality (on the road between Guadalajara and the west). There is also a place near Sayula, not far from the route over which Sessé and Mociño passed in 1791, which is listed as Amatitlán on AGS, Amatitán on ATLAS.

Amatlán de Cañas, Nayarit (Reyes Parra). AGS, 21-104c.

Ameca, Jalisco (Bárcena, Diguet, Nelson, Pringle). AGS, 21-104c. Also Cerro de Ameca, Sierra de Ameca, Valley of Ameca.

Amparo, El, Jalisco (Collins & Kempton). A ranch about 3 km south of Etzatlán (Jalisco, 1:100,000). Also cited as Ampaso and Arupara. Specimens cited as from "Los Teosintes, Ampaso," are presumably from this locality.

Angahuán, Michoacán (Straw & Gregory). AGS, 20-102c.

Antonio, Rancho de, Jalisco (Philbrick & Lewis). On the Río Guayavas, said to be 15 miles [24 km] southeast of San Juan Peyotán, not far from the mission of Santa Clara. Called Rancho San Antonio in Los Angeles Co. Mus. Contr. Sci. 68: 4 [map]. 1963.

Apatzingán, Michoacán (Ghiesbreght, Hinton, Lape, Leavenworth & Hoogstraal, McVaugh, Sessé & Mociño). AGS, 19-102a.

Apo, Michoacán (McVaugh). AGS, 19-102a. On the western slope of Cerro Tancítaro.

Apulco, Jalisco (McVaugh). AGS, 20-104d.

Aquila, Michoacán (Feddema, Hinton, Rzedowski). CARTA, Colima 13Q-VI, 1958, about 20 km southeast of Coahuayana.

Arandas, Jalisco (McVaugh). AGS, 21-102c. I visited this place September 29–30, 1952, by auto, via the road 5 miles (8 km) east of Tepatitlán, to Capilla de Guadalupe, and San Ignacio. The country east of Arandas was first explored in 1970, after the construction of a through road.

Aranjués, Jalisco (McVaugh). A small settlement at the junction of Río Aranjués (a tributary of Río Talpa) and Río Charco Verde, southwest of Talpa; see Cuale, Sierra del.

Arenal, Jalisco (Collins & Kempton, De Leon, Moore & Wood, Torres). El Arenal of AGS, 21-104d.

Amería, Colima (Hitchcock, Jones, McVaugh, Palmer). AGS, 19-104d.

Armerica River. See Tecomán.

Arrero, Mesa del, Colima (Kerber). See Colima, Colima.

Arroyo de Enmedio, Jalisco (Bárcena). The site of a former hacienda of this name, about 10 km southeast of Guadalajara, near the highway about halfway between Tlaquepaque and Puente Grande (Jalisco, 1:100,000).

Arroyo de Juan Sánchez, Nayarit (Nelson). A small settlement in the palm forest 28 miles northeast of Colomo, according to Goldman (1951, p. 201).

Arroyo del Obispo, Nayarit (Gentry). Said by Gentry to be 31 miles southeast of Tepic, near the highway to Guadalajara.

Arroyos del Agua, Jalisco (Feddema, Rzedowski). Said to be 10 km northwest of Huejuquilla el Alto.

Arupara, Jalisco. A corruption of Amparo, q.v.

Asientos, Aguascalientes (McVaugh, Rzedowski). AGS, 22-102a.

Astillero, Jalisco. A place-name now persisting in such combinations as Santa Cruz del Astillero (AGS). Bárcena (1891) refers to the Hacienda de la Venta del Astillero, 5 leagues west of Guadalajara. The railroad station in this vicinity is called La Venta (AGS, 21-104d). Sessé and Mociño refer to collections made on the grounds of the Belemite (or Carmelite) fathers here; they sometimes spell the name Hastillero: "in Praedio P. P. Belemitarum, Hastillero dicto haud procul a Guadalaxara." These authors also refer to a volcano by this name: "prope vulcanum del Astillero haud procul ab urbe Guadalaxarae."

Atarjea, La, Nayarit (Mexia). Near Ixtlán del Río, q.v.

Atemajac, Jalisco (Bárcena, Pringle, Sheldon). Atemajac del Valle of AGS, 21-103c.

Atengo, Jalisco (Martínez). AGS, 1959, 20-104a; CARTA, Guadalajara 13Q-IV, 1957. North-northeast of Ayutla, and about 10 km northwest of Tenamaxtlán. Also cited as "Cerro de Quelitán, Atengo," or as Atenco.

Atenguillo, Jalisco (Nelson). AGS, 20-104a; see also Goldman (1951, p. 169). Also spelled Altenguilla, Altanquillo, Atenquillo.

Atenquique, Jalisco (Pringle). AGS, 20-104d.

Atequiza, Jalisco (Gregg, Langman, Martínez, Pringle, Rose & Painter). AGS, 20-103a. Also spelled Ataquiza.

Atequizatlán, Jalisco (Correll). AGS, 20-104d. A road, little used except by pack animals since 1950, crosses from Zapotlán (C. Guzmán) to Sayulapa and the western slopes of the ridge north of the Nevado de Colima. Atequizatlán is on the eastern slope, in the pine forest. Sayulapa is near the summit of the ridge, 2 or 3 kilometers north of the truck road constructed by the paper company at Atenquique after Correll's visit. The road used by Correll enters the newer road about 5 km below (west of) the ridge, and about 3 km above a branch road which leads to El Izote, a locality also visited by Correll.

Aticama, Nayarit (Hernández X.). CARTA, San Blas 13Q-III, 1957. North of Miramar.

Atotonilco el Alto, Jalisco (McVaugh). AGS, 21-103d. Not to be confused with Atotonilco south of Lake Chapala, or Atotonilco el Bajo, southwest of Acatlán de Juárez on Laguna de Atotonilco.

Atotonilco, Laguna de, Jalisco (McVaugh). AGS. South of Acatlán de Juárez, 20-104b.

Atotonilquillo, Hacienda de, Guanajuato (Hartweg). Not located, but said to be near León. The type of *Ximenia parviflora* came from here. There is a place by this name 50-60 km southwest of León, 10 km southeast of Manuel Doblado (CARTA, Querétaro 14Q-III, 1956).

Atoyac, Jalisco (Kerber). So reported in Ann. Missouri Bot. Gard. 37: 367. 1950. This is probably Atoyac, Veracruz, near Córdoba where Kerber made most of his collections on his second trip to Mexico. Atoyac, Jalisco, is in an arid area on the east side of Lake Sayula, where the habitat would seem to be unlike that in the other localities reported for the species in question, *Triumfetta bogotensis*. Kerber seems to have made no other collections in this part of Jalisco.

Autlán, Jalisco (Crum, Gentry, Martínez, McVaugh, Wilbur). AGS, 20-104c. Numerous collections have been made in recent years, particularly in the mountains southwest of the city, on the seaward-facing slopes below the pass above La Resolana, and in the Sierra de Manantlán, q.v., some miles to the southeast.

Ayo el Chico, Jalisco (McVaugh). AGS, 21-102c.

Ayutla, Jalisco (Cronquist, McVaugh). AGS, 20-104a. West of Ayutla the first large town is Mascota, about 50 miles (80 km) distant. From Ayutla another road leads west to San Miguel de la Sierra, q.v.

Balaños, see Bolaños.

Barca, La, Jalisco (Gregg, Nelson, Pringle, Trelease). AGS, 20-103b. See Goldman (1951, pp. 172–174).

Barra de Navidad, Jalisco (Koelz, McVaugh). CARTA, Colima 13Q-VI, 1958; Navidad of AGS, 19-105b. From this point I travelled in one day (April 8, 1951) by car to Tequezquitlán, Concepción, La Resolana and Autlán. That road between Navidad and La Resolana is not accurately marked on maps. See Navidad, Bahía.

Barranca, La, Jalisco (Bárcena, Galeotti, Gregory & Eiten, Gregg, Hitchcock, Jones, Palmer, Pringle, Rose & Painter, Safford). The precipitous gorges of the Río Grande de Santiago, just northeast and north of Guadalajara; for explanation and map see Asa Gray Bull. II, 1: 385–390. 1953. For map see page 322 of this paper.

Barranca, La, "Nayarit" (Jones). Stated by Jones to have been "some 30 miles" east of Ixtlán, and the terminus, at the time of his visit in February 1927, of the Tepic-Guadalajara railroad. This is probably the station listed as Barrancas, just within the border of Jalisco (ATLAS, 1943, hoja Guadalajara). Here the railroad, and the highway, cross the deep branch-barranca which passes northward through Plan de Barranca to the Río Grande. The locality which Gregg called Barrancas (q.v.) is in the same general area. Pennell collected in 1935 in a locality which he designated as "Barrancas west of La Quemada, Jalisco"; he was traveling by train, and his locality was doubtless near to or identical with that of Jones.

Barranca de Beltrán (de Colimilla, de Huentitán, de Ibarra, de Oblatos, of Portillo, du Río Santiago, de Tepic, etc.). See under specific localities, as Beltrán, Barranca de.

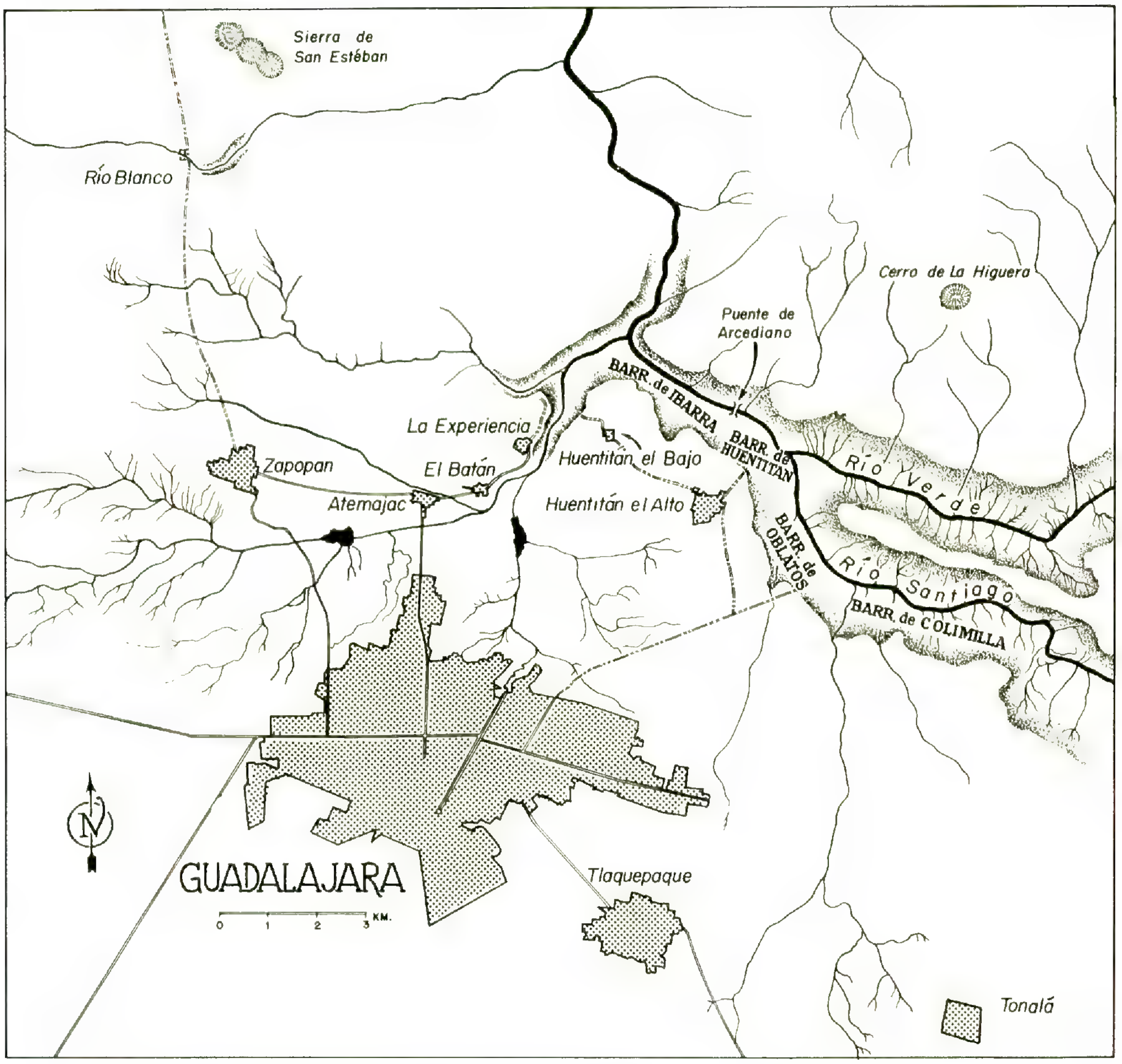
Barranca del Oro, Nayarit (Moran). AGS, 21-104c.

Barrancas, Jalisco (Gregg). This is the place near Mochitiltic, where the road between Magdalena and Ixtlán descends into the gorge; Gregg was here May 25 and 26, 1849. Jones' station called La Barranca, Nayarit, is in the same area, but the railroad crosses the end of the gorge somewhat above and to the south of the highway.

Barranquillas, Michoacán (Leavenworth & Hoogstraal). AGS, 19-102a.

Barranquitas, Jalisco (McVaugh). A small settlement just off the Guadalajara-Tepic highway, in the barranca near Mochitiltic, q.v.

Barroloso, El, Mpio. de Coalcomán, Michoacán (Hinton, McVaugh). The site (1965) of an extensive sawmill village on the high ridges ca 30–32 km nearly southwest of Aserradero Dos Aguas, at an elevation of about 2200 m.



Guadalajara and vicinity, showing the location of the principal *barrancas*. Map from Asa Gray Bull. II, 1: 389. 1953.

Belén, Jalisco (Bárcena). A ranch on the plain a few kilometers north of Guadalajara and northeast of Zapopan. Collections made by Bárcena were cited by Urbina (1897) as from "Belén, Valle de Guadalajara," or from Llano(s) de Belén. The place is called locally Rancho de los Belén. It is mentioned in Bárcena's list of populated places in Jalisco (Bárcena, 1891, p. 53) as Los Belenes.

Beltrán, Barranca de, Jalisco (Barcena, Jouy, McVaugh, Pringle, Seler). Descends from the east side of the Nevado de Colima to near San Marcos, q.v. on AGS, 19-104b. For Pringle's account of his visit to San Marcos and the Barranca de Beltrán, see Gard. & For. 7: 172–173. 1894. Cited as Beltrán on some labels, or as Veltran by Jouy, who collected birds here.

Bolaños, Jalisco (Coulter, Diguet, Hartweg, Rose, Zingg). AGS, 22-104d. Also spelled Balaños, Bolanos, Bolonas, Boloñas, Polanos.

Bolaños to Guadalajara, Jalisco (Rose). In 1897, while traveling with Nelson and Goldman, Rose made about 75 collections along the road between these places. The itinerary, as given by Goldman (1951, p. 176), was as follows: September 19, leave Bolaños and descend the cañon of the Río Bolaños about 23 miles; September 20,

37 miles southeasterly, crossing a mountain range near La Laguna, Jalisco; turning southeasterly and crossing into Zacatecas near Florencia and continuing to El Conejo; September 21, 46 miles, via Estanzuela, Zacatecas; Malacate, Jalisco; and San Cristóbal de la Barranca, Jalisco.

Buenavista Tomatlán, Michoacán (McVaugh, Rzedowski, Sessé & Mociño). Tomatlán of AGS, 19-103b.

Bufa, La, Jalisco (Mexia). CARTA, Guadalajara 13Q-(IV), 1957. Said by Mrs. Mexia to be the highest peak near San Sebastián, q.v., and to have an elevation of 2500 meters. Called by Nelson Bufa de Mascota; described by Goldman (1951, p. 179), and said to be about 5 miles southeast of San Sebastián.

Bules, Los, Nayarit (Goldsmith). On the Río Jesús María, about 25 km south of Jesús María, q.v. ATLAS, Zacatecas sheet, 1944; AGS, 1959, 22-105b.

Cabo Corrientes, Mpio. de, Jalisco. See El Tuito. As far as I am aware, no botanical collections have ever been made on the cape itself or in the mountains between the Cape and El Tuito.

Cachán, Michoacán (Hinton). Not located on a map. The Río Cachán empties into the Pacific at a point southeast of Pómaro, between 103°05′ and 103°15′ W. long.

Calabazas, Jalisco (Reko). Also spelled Calabazos. Not located, but possibly the same as Calabozo of AGS 19-103a, a small place near the railroad just east of Tonila, in the same general area where Reko is known to have collected.

Caleras, Colima (Hitchcock). AGS, 19-104d. Also spelled Caldras.

California, Hda., Michoacán (Leavenworth & Hoogstraal, Rzedowski). Near Apatzingán, on the road to Aguililla. Not located on a map.

Calixcillo, Nayarit (Mexia). Near Tepic, q.v.

Calvillo, Aguascalientes (McVaugh & Koelz). AGS, 22-103d.

Campana, Sierra de la, Jalisco (McVaugh). About 12–15 km northwest of Los Volcanes, q.v.

Canelillas, Arroyo de las, Jalisco (Mexia). Near Real Alto, q.v.

Cangrejo, Nayarit (Norris). A settlement near Mesa Nayar, one day's journey west of Jesús María.

Canoas, Las, "Jalisco." A locality cited by Urbina (1897). The collections cited (*Pringle 3827, 3936*) were made at Las Canoas, S. L. P.

Cañada, La, Jalisco (McVaugh). The site of a sawmill southwest of Ayutla, between San Miguel de la Sierra and Santa Mónica, q.v.

Cañas, Las, Zacatecas. See Huejúcar.

Capilla, La, Jalisco (Martínez, Pringle). AGS, 20-103a. A railroad station southeast of Guadalajara. Spelled Capella by Pringle.

Capilla de Guadalupe, Jalisco (McVaugh). AGS, 1959, 21-103d; CARTA, Guadalajara 13Q-(IV), 1957. About 20 km east of Tepatitlán on the road to Arandas.

Capiri, El, Michoacán (Leavenworth & Hoogstraal). Capirio of AGS, 19-102c.

Carmen, Colima (Moran). Not located on a map. Said to be in the Sierra de los Tejones, about 30 miles more or less northwest of Manzanillo.

Carmen, El, Jalisco (Cronquist, McVaugh). A very small settlement with a school; in the so-called Sierra del Parnaso of AGS, southeast of Talpa and north of west of Ayutla. See San Miguel de la Sierra.

Casa Fuerte, Jalisco (Griffiths). Not located.

Casillas, Arroyo de las, Jalisco (Mexia). Near San Sebastián, q.v.

Casimiro Castillo, Jalisco. CARTA, Colima 13Q-VI, 1958. The official name of the place usually called La Resolana, q.v. Collections were made near here on Cerro el Tecolote.

Casitas, Arroyo de las, Jalisco (Mexia). Near San Sebastián, q.v.

Castillo, El, Jalisco (Oliva, Pringle). Pringle's locality was the railroad station of this name (AGS, 21-103c), in the vicinity of which he collected on several occasions. Oliva is reported (Contr. U.S. Nat. Herb. 28: 35. 1929) to have collected at Hecla del Castillo, "Republic of Mexico"; the word "Hecla" is apparently derived from a misinterpretation of an abbreviation of "Hacienda," and Oliva's locality is probably the Hacienda del Castillo, Jalisco (AGS, 21-103c, as El Castillo).

Cavianes, Río, Jalisco (Jones). See Covianes.

Ceboruco, Volcán, Nayarit (Hartweg, McVaugh, Paray). AGS, 21-104a. The road from Ixtlán to Tepic crosses extensive rough lava-flows from this volcano, south and southwest of the summit. The first recorded eruptions were during the period from 1870 to 1875, when large quantities of lava were emitted (Bárcena, 1891, p. 249). Lava from earlier flows, however, formed the "malpais" where Gregg collected, in this same locality, May 26, 1849.

Cerrero, Mesa del, Colima (Kerber). See Colima, Colima.

Cerro de Ortega, Colima (McVaugh). A small settlement at the Río Coahuayana, across from the town of Coahuayana, on the road from Tecomán.

Cerro de la Cruz. See Cruz, Cerro de la.

Cerro Grande, Jalisco (Burnett). Not located, but see Burnett in index to collectors.

Cerro San Juan, Nayarit. See San Juan, Cerro.

Chacala, Nayarit (McVaugh). AGS, 21-105a.

Chacalapa, Michoacán (Hinton, Sessé & Mociño). AGS, 19-104d.

Chamela, Jalisco (McVaugh, Pérez J.). AGS, 20-105c.

Chante, El, Jalisco (Crum, McVaugh, Wilbur). CARTA, Colima 13Q-VI, 1958. A good-sized town about 20 km (airline) southeast of Autlán, used (1949) as an outfitting point for pack-trips further southeast into the Sierra de Manantlán, q.v. Oddly enough Chante does not appear on most maps of this area. Between 1959 and 1965 a lumber-road was constructed from El Chante into the Sierra, to replace the former road from Santiago via Durazno, washed out by the 1959 hurricane.

Chapala, Lago de, Jalisco or Michoacán (Galeotti, C. L. Hitchcock, Jouy, Lemmon, Nelson, Pringle, Rowell, Schery, Sessé & Mociño, Sheldon). AGS, 20-103a. Most of the shoreline is in Jalisco; the southeastern side, however, from about long. 103° east to the mouth of the Río Lerma, is in Michoacán. Most collections are labelled in English, i.e. as from Lake Chapala; probably few are from the lake itself, but rather from the mountains on the north side, or mountainsides above the road which parallels the south side.

Chapalagana, Río, Jalisco (see Philbrick & Lewis). AGS, 22-104a.

Charco Verde, Río, Jalisco (McVaugh). See Cuale, Sierra del.

Chicalote, Aguascalientes (Nelson). AGS, 22-102a. A railroad junction-point about 15 km north of Aguascalientes. Nelson & Goldman collected here, July 1–7, 1896 (Goldman, p. 35).

Chila, Michoacán (Feddema, Rzedowski). Said to be 8 km northwest of Aquila, q.v.

Chinampas, Hda. de, Jalisco (McVaugh, Shreve). Chinampas of AGS, 22-102d.

Chinicuila, Mpio. de, Michoacán (Hinton). Chinicuila, the place that gives its name to the municipality, is listed on AGS, 19-103c; since 1924 it has been officially known as Villa Victoria. Hinton collected at Villa Victoria and also at Huizontla, Sierra Naranjillo and Tehuantepec in this *municipio,* but located all these places in the old *distrito* of Coalcomán.

Chiqueritos, Cerro de, Mpio. de Coalcomán, Michoacán (Madrigal S.). About 3 km northwest of Dos Aguas, q.v.

Chiquilistlán, Jalisco (Jones). AGS, 20-104b.

Ciénaga, La, Nayarit (Norris). A high summit in the Sierra del Nayarit, nearly west of Jesús María and south of Santa Teresa, said to reach an elevation of 2800 m. Probably west of Ciénega of AGS, 22-105b.

Ciénega de Mata, Jalisco (McVaugh). AGS, 22-102a. Apparently the same as La Ciénega of Rzedowski.

Ciénega Grande, Aguascalientes (Coulter, McVaugh). AGS, 22-102a.

Cihuatlán, Jalisco (McVaugh & Koelz). AGS, 19-105b.

Cirata, La, ?Nayarit (Gregg). Not located, but presumably in this state and near Ixtlán del Río; Gregg collected here May 26, 1849. The name as written may be from a misinterpretation of Gregg's notes.

Ciudad García, Zacatecas (Martínez, Muller). AGS, 23-103c. Formerly Jérez or Xeres.

Ciudad Guzmán, Jalisco (Collins & Kempton, Cutler, Gregory & Eiten, Martínez, Moore). AGS, 20-103c. Formerly Zapotlán, q.v.

Coahuayana, Michoacán (Emrick, Hinton, McVaugh, Sessé & Mociño, Turner). AGS, 19-104d. Sometimes reported as in the State of Colima, or spelled Cohuayana. Hacienda Coahuayula, Michoacán, where Emrick made a large collection in February, 1901, is sometimes wrongly cited as Coahuayana.

Coahuayula, Michoacán (Emrick). According to Brand (Coalcomán and Motines del Oro, p. 158), in the 1890's an American named Fortune acquired some of the lands of the pueblo San Juan Huitzontla, including the lake of Guavayutla, and founded the Hacienda Coahuayula. It may be located approximately as between Aquila and Tehuantepec, near the head of the Río de Ostula.

Coalcomán (de Matamoros), Michoacán (Hinton, Rzedowski). AGS, 19-103c. The town of Coalcomán (de Matamoros) gave its name to a *distrito* which at one time (see AGS) took in most of the part of Michoacán south and west of the Río Balsas-Tepalcatepec. Hinton's collections from "Distr. Coalcomán" were taken from localities in the present *municipios* of Coahuayana, Aquila, Chinicuila, Coalcomán, and Aguililla.

In May, 1963, Rzedowski explored the vicinity of Tepalcatepec, travelled to Jilotlán, and tried unsuccessfully to reach Ahuijullo. He went then by the direct

road from Tepalcatepec to Coalcomán, stopping briefly to collect at Puerto de las Cruces and at Salitre.

Coalcomán, Mpio de, Michoacán. See Coalcomán de Matamoros. Hinton collected in this *municipio* at or near Barroloso, Coalcomán, Cuchilla, Ocorla, Palmitas, Parotas del Cobre, Pie de la Cuesta, Puerto de Aire, Puerto de las Cruces, Puerto Zarzamora, Salitre, San José, Tiquiluca, Sierra Torrecillas, and Trojes (cf. Brand, 1960, p. 231.)

Cocula, Jalisco (Collins & Kempton, McVaugh, Pippen, Reko). AGS, 20-104b. Collections were made by Collins and Kempton at Hacienda San Diego, near Cocula.

Cofradía, La, Nayarit (Mexia). Near Ixtlán del Río, q.v., and said by Mrs. Mexia to be north of that place. Also spelled Copradia.

Coire, Michoacán (Hinton). AGS, 18-103a, as Coira. Usually spelled Coyre by Hinton.

Colima, Colima (Diguet, Dugès, Emrick, Fernow, Galeotti, Ghiesbreght, Gilly, Hitchcock, Jones, Kerber, Langman, Murrill, Orcutt, Palmer, Roezl, Sessé & Mociño, Seler, Turner, Woods). AGS, 19-104b. *Liebmann XII 1840, Malpighia galeottiana,* reported from Colima in *Das Pflanzenreich,* is doubtless from Colipa, Veracruz. Kerber collected at various localities near Colima, and recorded the following local names, which seem not to be otherwise known: Tromptero, Mesa del Arrero (Ann. Missouri Bot. Gard. 1: 279. 1914); and Mesa del Cerrero. Some collections reported merely as from "Colima" were probably made well northeast of the city, on the slopes of the volcano.

Colima, El Nevado de, Jalisco (Bárcena, Correll, Gadow, Gregory & Eiten, Hitchcock, McVaugh, Pringle, Reiche, Roezl, Ross). AGS, 20-104d. Called by Bárcena, Volcán del Nevado, Volcán del Nevado de Colima, or Nevado de Colima; by Goldman (1951, p. 180) Sierra Nevada de Colima; by Hitchcock (Scient. Mo. 8:131, 138. 1919) Nevada de Colima or Nevada Peak; and by Correll (U.S.D.A. Agric. Monog. 11: various pages. 1952) Volcán de Nevada. By those who live nearby the "snowy peak" is called the Volcán de Nieve, in contrast to its smaller neighbor, the Volcán de Fuego. Called also Pico de Colima.

Colima, Volcán de, Jalisco (Bárcena, Galeotti, Goldsmith, Jones, Kerber, Pringle, Puga, Reiche, Roezl, Ross, Seler, Sessé & Mociño). AGS, 20-104d. Also called Colima Volcano, Volcano of Colima, and Mt. Colima. References to the "volcano" of Colima should be examined with caution. The elevation which culminates in the twin peaks (the "Volcán de Fuego," 3850 m, and the "Volcán de Nieve," 4340 m),[1] is small in areal extent, and very conspicuous for a distance of many miles, so that the whole mountain mass is often spoken of loosely as "the volcano." In fact the active volcano, the smaller peak, arises from the southern slope of the higher peak, the Nevado. Many collections labelled as from the "Volcano of Colima" (e.g. some of those made by Jones and Ross), surely came from the relatively moist northern slopes of the Nevado, not from the loose volcanic rubble of the active cone. Jones, Kerber, Pringle, Reiche and Ross, however, did visit the active cone, and perhaps all made some collections there. Several collections by Bárcena are specifically cited as from the "Volcán de fuego" (Urbina, 1897).

Colimilla, Barranca de (Gentry & Gilly). One of the upper stretches of the great complex of *barrancas* near Guadalajara. See map, Asa Gray Bull. II, 1: 389. 1953, or page 322, above.

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[1] 4265 m, according to some recent maps.

Colli, Cerro del, Jalisco (Castillo, Gregory & Eiten, McVaugh, Sessé & Mociño). A small volcanic cone about 15 km west of Guadalajara. Shown (as Cerro del Col) by Bárcena (1891, map facing p. 262). Also called El Colli.

Colomitos, Jalisco (Bárcena). Also called Los Colomitos. About 15 collections from this place are cited by Urbina (1897), who calls it "Colomitos, Valle de Guadalajara." Not located, but apparently on the plains near the city.

Colomo, Jalisco (Langman). Said by Mrs. Langman to be near Zapopan, and presumably the same as Los Colomos, a small place about halfway between Zapopan and Guadalajara (Jalisco, 1:100,000).

Colomo, Nayarit (Nelson). El Colomo of AGS, 21-105c (Colomo of AGS, Index, p. 45).

Colomos, "Jalisco" (Rose). Reported in Ann. Missouri Bot. Gard. 37: 365. 1950. The place of this name at which Rose collected, in 1897, is in northeastern Sinaloa; see Goldman (1951, p. 250).

Colomos, Jalisco (Martínez). Not located on a map; reported in An. Inst. Biol. [Méx.] 21: 51. 1950. According to Martínez (in lit.) this is a ranch of the Municipio de Mascota.

Colorado, Mesa, Jalisco (Pringle, Shaw). Between Etzatlán and Ameca; see Davis (1936, p. 223).

Colotlán, Jalisco (Coulter, Rose). AGS, 22-103a.

Colotlán to Bolaños, Jalisco (Rose). Rose travelled over this route in 1897 with Nelson and Goldman; the itinerary is given by Goldman (1951, pp. 170–171): September 7, 30 miles southwesterly from Colotlán to Totatiche, Jalisco; September 8, 35 miles in the same direction, to El Romerio; September 9, 10 miles southwesterly to Bolaños.

Comala, Colima (Langman). AGS, 19-104b.

Comanjilla (or Comanjillo) (Hartweg). Two of Hartweg's early Mexican collections are cited as having been found "ad balneas Comanjilla[o]" (Bentham, Pl. Hartweg. 30, 32. 1840). This is presumably not a locality in Jalisco, but the well known hot springs near the city of Guanajuato.

Comatán, Salto de, Nayarit (Hernández X.). Near Tepic; not otherwise located.

Compostela, Nayarit (Gentry & Gilly, Hartweg, McVaugh & Koelz, Martínez, Nelson). AGS, 21-105b.

Concepción, Jalisco (McVaugh). AGS, 20-105d. See Barra de Navidad.

Concepción, La, Jalisco (Bárcena). AGS, 21-103c. A locality cited by Urbina (1897) as Hacienda de la Concepción or Llano de la Concepción or, in one case, as "Llano de la Concepción, Valle de Ahualulco." Apparently this last is an error; Bárcena's collections may have come from the hacienda of La Concepción, about 20 km south of Guadalajara, but see also Concepción del Volcán.

Concepción de Buenos Aires, Jalisco (McVaugh). AGS, 20-103c. Cited by Martínez (1948, p. 184).

Concepción del Volcán, Hacienda de la, Jalisco (Bárcena). Not located, but stated by Bárcena (1891, pp. 354-355) to have been, at the time of his visit in 1886, in the oak-pine woods on the western slopes of the Volcán de Fuego, 7 km from the volcano, and at an altitude of 1321.4 meters (op. cit. 222). Urbina (1897) cited Hacienda de la Concepción as one of the localities at which Bárcena collected plants.

Constancia, Jalisco (Pringle). A station on the railroad southeast of Guadalajara; the first station west of Poncitlán (north of Lake Chapala, at about 103° W. long.).

Copradia. See Cofradía.

Coquimatlán, Colima (A. S. Hitchcock, Rzedowski). AGS, 19-104b. Sometimes spelled Coquitlán on herbarium labels.

Corales, Sierra de los, Jalisco (Feddema, Rzedowski). An area west of Jilotlán and northwest of Tepalcatepec, visited by these collectors in 1963. See the description under Rzedowski in the list of collectors.

Corazón, Mesa de, Jalisco (Azcón). Near Cuale, at an elevation of 2000 to 3000 meters; cited by Martinez (1948, pp. 155, 305).

Corcovado, Jalisco (McVaugh). AGS, 20-104c.

Cordoncillera, Arroyo de la (Phillips). Near Puerto Vallarta, q.v.

Coronilla, Cerro de la, Jalisco. See Tecolotlán.

Corralitos, Jalisco (McVaugh & Koelz). CARTA, Colima N-E-13(II), 1949. Shown about 17–18 km south of Autlán; it was a thriving sawmill town in 1959.

Cortijo, Hacienda de, Jalisco (Bárcena). Not located on a map, but cited by Urbina (1897) as in the "Valle de Tuxpam," and located by Bárcena (1891, p. 76) in the Municipio de Zapotiltic.

Cotija de la Paz, Michoacán (McVaugh, King & Soderstrom). AGS, 20-103d.

Covianes, Río de, Jalisco (Jones). Called by Jones Rio Cavianes or Cuvianes. An older name for the stream now called Río de Tuxpan. In a description of Hacienda San Marcos (Bárcena, 1891, p. 487) is the following reference: "Existen cinco manantiales . . . además el rio de Covianes, que va á formar el Coaguayana." Jones crossed the river on June 13, 1892, on his way between Zapotiltic and Santa Cruz. In 1791 a ranch of this name existed in the same area, in the upper valley of the river (Not. Varias N. Galicia, p. 119. 1878, where spelled Covianos).

Coyultitas, Nayarit (Goldsmith). Coyoltita of AGS, 22-104c. Also spelled Cayultitas.

Cruz, Cerro de la, Jalisco (Mexia). A steep volcanic mountain near Puerto Vallarta; see Cruz de Vallarta.

Cruz, Cerro de la, Nayarit (Collins & Kempton, Mexia). A prominent low mountain within sight of the city of Tepic, q.v. Also cited as Cerro del Cruz.

Cruz de Vallarta, Jalisco (Mexia). Near Puerto Vallarta, q.v. In Mrs. Mexia's notes the elevation is given as 700 meters; see also Cerro de la Cruz, Jalisco, Santa Cruz de Vallarta, and the description in Madroño 1: 232. 1929.

Cuadrilla, La, Jalisco (Mexia, Nelson). About 6 miles "below" San Sebastián, q.v., according to Goldman (1951, p. 179). Also spelled Quadrilla.

Cuale, Jalisco (Azcón, Martínez). AGS, 20-105a. Collections were also made by Azcón between Cuale and Talpa, and near Cuale on the Mesa de Corazón. The collections attributed to Martínez (e.g. in An. Inst. Biol. [Méx.] 17: 69. 1946 and 19: 73. 1948) were made by others; see text, page 282.

Cuale, Sierra del, Jalisco (McVaugh). AGS, 20-105ab. The high range southwest of Talpa de Allende. The highest peak is called locally Cerro Piedra Rajada. In 1952 we reached the southern base of the peak with pack train after 5–6 hours' travel from Talpa, first about two hours to the south and southwest, up the Río Aranjués to Aranjués, whence we ascended the Río Charco Verde to the west about one hour, then finally westward through the foothills for two hours.

Cuartón, El, Jalisco (Crum, McVaugh, Wilbur). Reputedly the highest peak in the Sierra de Manantlán, q.v. The sawmill called El Cuartón was in 1952 the highest on the road into the Sierra de Manantlán from the south. All collectors in 1949 approached the peak from the direction of Autlán, i.e. northwest; in 1952 I came to Aserradero El Cuartón from the south, i.e. from Manzanillo.

Cuatante, El, Nayarit (Feddema, Rzedowski). Said to be 40 km north-northeast of Puerto Vallarta, on the road to Tepic, in the Municipio Valle de Banderas.

Cuautla, Jalisco (McVaugh). AGS, 20-104a, where shown (as on most older maps) about 10 km west-southwest of Ayutla. On AGS, 1959, and on many modern maps, it is shown correctly, about 15 km northwest of Ayutla.

Cucaracha, La, Nayarit (McVaugh). CARTA, San Blas 13Q-(III), 1957, about 15 km south of Las Varas. La Cucaracha Colimilla of AGS 1959, 21-105a.

Cuchilla, La, Jalisco (Goldsmith). A locality said to be on the northeast side of the Volcano of Colima, between 8500 and 10500 feet of elevation. As Goldsmith probably ascended from near San Marcos, La Cuchilla is probably below the saddle between the active volcano and the Nevado. Also spelled Cuhilla.

Cuesta, La, Jalisco (McVaugh). Cuesta of AGS, 20-105b.

Cuesta de San Luisito. See San Luisito, Cuesta de.

Cumbre, La, Jalisco (McVaugh). A sawmill village (1960, 1965) more or less south of Mirandilla and east of Talpa, near the north end of the Sierra del Parnaso of AGS at an elevation of ca 2000 m; see San Miguel de la Sierra.

Cura, Arroyo (or Hacienda) del, Jalisco (Mexia). Near San Sebastián, q.v.

Cuvianes. See Covianes.

Cuyutlán, Colima (McVaugh). AGS, 19-104c.

Cuzalapa, Jalisco (McVaugh). AGS. 20-104c.

Degollado, Jalisco (Pippen). AGS, 20-102a.

Delicias, Las, Nayarit (Mexia). AGS, 22-105d.

Dolores, Nayarit (Rose). AGS, 22-105b; see also Goldman (1951, p. 202).

Don Tomás, Rancho, Colima (Contreras). North of Manzanillo, according to Matuda in An. Inst. Biol. [Méx.] 25: 116. 1954.

Dos Aguas, Aserradero, Michoacán (W. R. Anderson, McVaugh). Since 1955 or before a large sawmill village, at an elevation of about 2100 m, near the summits of the high ridges intervening between Aguililla and Coalcomán. From Dos Aguas a lumber road extends toward El Barroloso, 30–32 km to the southwest. Dos Aguas is almost due west, by line of sight, from Aguililla. I have assumed that most of the places where collections were made near Dos Aguas were in the Municipio de Coalcomán, but some on the lower slopes of the mountains may be in the Municipio de Aguililla. The road from Apatzingán (1965, 1970) crosses the Río Tepalcatepec bridge, then continues toward Aguililla for about 40 km, leaves the main road and then climbs 40 km or a little more by a circuitous route to Dos Aguas. Most of our collections were made below Dos Aguas, on the northeastern faces of the escarpments. The position of the mountains is not accurately shown on any map I have seen.

Durango (Rose). Rose made numerous collections, August 13–16, 1897, in the "Sierra Madre near Huazamota, Durango." Most of these are labelled merely "Durango." For the route followed see Goldman (1951, pp. 144, 288).

Durazno, Jalisco (McVaugh). In 1952 a temporary village and base-camp for lumbering operations north or northeast of Cuzalapa, at the foot of the mountains between Cuzalapa and El Chante, at an elevation of about 1000 m. It was abandoned some years before our second visit in 1965. See Sierra de Manantlán.

Ecobedo. See Monte Escobedo.

Encarnación, La, "Jalisco" (Ehrenberg, Schiede). This locality, which is actually in Hidalgo, has been cited several times in the literature as from Jalisco.

Encarnación de Díaz, Jalisco (Johnston, Knobloch, Muller). AGS, 22-102c. See Lagos de Moreno.

Escalón, Jalisco (McVaugh). AGS, 21-103a.

Escoba, La, Jalisco (Pringle). A small settlement on the plain about 10–12 km northwest of Guadalajara, 1.5 km northwest of Río Blanco.

Escobado, Escobedo. See Monte Escobedo.

Esperanza, La, Jalisco (Pringle). Same as Experiencia, La, q.v.

Esperanza, La, Jalisco (Reiche). Jalisco, 1:100,000. An hacienda between Tonilita and Tonila, in the valley of the Río Tuxpan, where Reiche made his headquarters for a time, in preparation for an ascent of the volcano of Colima.

Espino, Arroyo del, Nayarit (Muller). Cited in An. Inst. Biol. [Méx.] 25: 49. 1954, as "Arroyo del Espino, Jala"; see Jala.

Estancia, La, Jalisco (Mexia). Near San Sebastián, q.v.

Estanzuela, Jalisco (Griffiths). AGS, 21-104d. Also spelled Estansuela.

Estanzuela, Jalisco (McVaugh). AGS, 21-104c. Also cited as La Estanzuela.

Estanzuela, Zacatecas (Nelson & Goldman, Rose). AGS, 21-104b. See Bolaños to Guadalajara.

Etzatlán, Jalisco (Barnes & Land, Holway, Collins & Kempton, Pringle, Rose & Painter, Shaw). AGS, 21-104c. Pringle and Shaw (October 23, 1904) went from Etzatlán nearly to Santo Domingo mine, and to Mesa Colorado and the trail to Ameca.

Experiencia, La, Jalisco (Langman, Pringle). AGS, 1959, 21-103c. A settlement north of Guadalajara, at the head of the *barranca* of the same name. Often visited by Pringle on his way to the *barranca,* but usually called by him Esperanza or Experienza. See Asa Gray Bull. II, 1: 389. 1953.

Ferreria de Tula, Jalisco (Jones, Shaw). AGS, 20-104b. Called Ferreria by Jones and Tula by Shaw. Also spelled Ferraria, Terreria.

Fluejotitan, Jalisco. An error for Huejotitán, q.v.

Fresno, Nayarit (Collins & Kempton). ATLAS. A small place just south of Tepic, called also El Fresno, or Los Fresnos.

Frijol, Jalisco (Kerber). Not located, but perhaps on the lower slopes of the Volcán de Colima, near San Marcos.

Fuerte, El, Cerro, Guanajuato (Arroyo F.). Said to be near Pénjamo.

Fundición, Arroyo de la, Nayarit (McVaugh & Koelz). A wooded ravine with what appeared to be a permanent stream, on the mountain road to Barrancas del Oro, about 8 km above (southeast of) Ahuacatlán, at an elevation of 1300 m.

Gachupín, Jalisco (Bárcena, Kerber). A ranch between Tonila and San Marcos, at the lower edge of the pine forest on the Volcán de Colima. Cited by Kerber as Gachupines, and by Urbina (1897) as El Gachupín or Rancho del Gachupín.

Gallardo, Jalisco (Feddema, Rzedowski). Said to be a small ranch 10 km northwest of Tepalcatepec, in the Mpio. de Tecalitlán.

Gallos, Cerro de los, Jalisco (McVaugh). AGS, 22-102c. The mountain (elev. 2360 m) is nearly on the line between Jalisco and Aguascalientes. We approached it in 1958 from the south and east, via Hacienda Las Rosas which lies about 5 km east of the summit.

García, Cerro de, Jalisco. See Tuxcueca.

Garita, La, Jalisco (McVaugh & Koelz). CARTA, Colima 13Q-VI, 1958. A settlement on the highway about halfway between Tamazula de Gordiano and Mazamitla, near the beginning of the steep ascent into the Sierra del Tigre.

Garita del Sur, Guadalajara, Jalisco (Bárcena). A former tax-station or toll-gate of the city.

Garote (or Garrote), Loma de, Jalisco (Mexia). Not located, but near San Sebastián, q.v.

Gordo, Cerro, Jalisco (McVaugh). CARTA, Guadalajara 13Q-(IV), 1957, listed as C. Gordo de Tepatitlán. Elev. 2666 m. It lies about midway between Arandas and Tepatitlán.

Grullo, El, Jalisco (Hernández X.). CARTA, Colima 13Q-VI, 1958. It is about 16 km a little north of east of Autlán.

Guadalajara, Jalisco (Altamirano, Bárcena, Barnes & Land, Coulter, Diguet, Erlanson, Furness, Gaiser, Galeotti, Griffiths, Hitchcock, Holway, Jones, Jouy, Langman, Leavenworth, Martínez, McVaugh, Oliva, Orcutt, Palmer, Pringle, Reko, Rose, Rose & Hay, Rose & Hough, Rose & Painter, Rowell, Rowntree, Safford, Schaffner, Sessé & Mociño, Sheldon, Weintraub). AGS, 21-103c. Formerly usually spelled Guadalaxara. Many collections cited as from Guadalajara are neither from the city itself nor from the surrounding plains, but from the nearby *barrancas* or as far away as Río Blanco, Zapopan, or San Pedro; see these places and also Barranca, La, Astillero, and Colli. Some of Mrs. Langman's collections are labelled also: Guadalajara–Tequila road, –Autlan road, –Chapala road, and –Mexico City road. Mrs. Weintraub collected along the road to Tepatitlán, and at various points along the road between Guadalajara and Jiquilpan, Mich.

Guadalajara, Valle de, Jalisco (Bárcena, Gómez y Gutiérrez). The area included in the "valley" of Guadalajara comprises chiefly the drainage basin of the waters which flow off to the northeast by way of the Barranca de Experiencia. It is a relatively small area, bounded on the northeast by the *barrancas* of the Río Grande, on the south by a line extending from Puente Grande or Tonalá, westward to the Cerros del Astillero or the extinct volcano of El Colli; on the west by an arbitrary line extending north or somewhat northwest; and on the north by another arbitrary line a little north of Río Blanco. See the statement by Bárcena (1891, p. 210) or, for a more precise statement, the description of the area by Gómez y Gutiérrez (Bol. Junta Aux. Jal. Soc. Mex. Geog. y Est. 5: 188. 1945). Scores of local place-names, within the area comprised by the valley of Guadalajara, are recorded by Agustín Gómez y Gutiérrez in his *Flora Silvestre del Valle de Guadalajara,* cited above. For the most part these have not been included in the present list except as they have been cited elsewhere in published works.

Guajes, Los, Nayarit. See Ixtlán del Río.

Guajolote, Nayarit or Durango (Seemann). Not located, but visited by Seemann probably in late January, 1850; see under Seemann in the index to collectors.

Guanacaste, La Cruz de, Nayarit (Rzedowski). Said to be in the Mpio. Valle de Banderas.

Guayavas, Jalisco (Philbrick & Lewis). Said to be 25 miles [40 km] south-southeast of San Juan Peyotán; in the valley of Río Guayavas, an affluent of Río Chapalagana. On early maps by Diguet and Lumholtz, Guayavas is shown just southwest of San Andrés.

Guaynamota, Nayarit (Goldsmith). AGS, 22-105d. See Jesús María. Also spelled Guainamota, Huainamota, or Huaynamota.

Halo, Sierra del, Jalisco (Diguet, McVaugh & Koelz). The large range of mountains rising to the east of Pihuamo and south of Tecalitlán. Since 1957 or before, access to the high ridges above Pihuamo has been possible by a lumber road leaving the Colima highway about 11 km southwest of Tecalitlán, or 3 km above the highway bridge called Puente de San Pedro. In 1957 and 1959 the road continued in a southerly direction to a large sawmill village called San Isidro, about 25 km from the highway. In 1970 the road by-passed San Isidro and continued 5–6 km to Plan de Lego, the new center of lumbering operations. Here a branch road began the descent to the east toward Jilotlán. The mountains on the eastern slopes have various local names; cf. Sierra de los Corales. Called Sierra del Alo by Diguet. Martínez (An. Inst. Biol. [Méx.] 11: 78. 1940) reported collections from a Cerro del Lalo or (1948) "Cerro del Halo, Tecalitlán," and gave the elevation as 3500 m.

Hastillero. See Astillero.

Hecla del Castillo, Jalisco (Oliva). See Castillo.

Hedionda, Poso, Jalisco (Mexia). Near Real Alto, q.v.

Higuera, Jalisco (Jones). AGS, 19-103a. Called Rancho Higuerro by Jones.

Honey, "Jalisco" (Barnes & Land). So reported in Field Mus. Publ. Bot. 2: 341. 1912. Honey was a station on the railroad northeast of Tulancingo, Hidalgo, a favorite collecting ground of Pringle. The collection cited as from Jalisco was made on October 21, 1908, when Barnes & Land were at Honey with Pringle (Davis, 1936, p. 249).

Hornos, Arroyo de los, Jalisco (Mexia). Near Ototal, q.v.

Hostotipaquillo, Jalisco (Sessé & Mociño). AGS, 21-104a. Sessé & Mociño also refer to San Thoma (or San Toma) near this place.

Hoya, La, Jalisco (Pringle). See Joya, La.

Huacasco, Jalisco (McVaugh). AGS, 22-103a.

Huachinango, Jalisco (Nelson). Guachinango of AGS, 21-104c.

Huaristemba, Nayarit (Barclay). AGS, 1959, 22-105c; CARTA, hoja San Blas, 1949. About 15 km northeast of San Blas. See Tepic.

Huasemote, Durango (Rose). Huazamota of AGS, 23-104c. See also Durango.

Huejotitán, Jalisco (Diguet). AGS, 20-103a. Also spelled Fluejotitan. Diguet visited this area in 1903 and made some collections on what he called Cerro de Huejotitán, i.e. probably the mountain called El Viejo (2960 m) just northwest of Lake Chapala. In 1912 he made a large collection, probably nearly all on the slopes of El Viejo, but

invariably gave the locality as Huejotitán. The altitudes in meters, as stated by Diguet, are often considerably greater than that of the settlement, suggesting that the collections were made well up in the mountains.

Huejúcar, Jalisco (McVaugh). AGS, 22-103a. Collections were made, April 15, 1951, along a road between this place and Monte Escobedo, Zacatecas. About 9 miles (15 km) southwest of Huejúcar the summit of the ridge is called locally La Mesa de María de León; a small settlement 15 miles (25 km) from Huejúcar is called Las Cañas.

Huejuquilla, Jalisco (Feddema, McVaugh, Rose, Rzedowski). Huejuquilla el Alto of AGS, 23-104d. Also spelled Huejuguilla, Huijuquilla.

Huentitán, Jalisco (Langman, Oliva, Weintraub). One of two small villages on the plain northeast of Guadalajara; see Asa Gray Bull. II, 1: 389. 1953, or see map above, page 322. Huentitán Bajo is shown on AGS, 21-103c.

Huerta, La, Jalisco (McVaugh, Rzedowski). CARTA, Colima 13Q-VI, 1958, 19-105b. Across the coastal ranges, about 35 km nearly north of Barra de Navidad. Not to be confused with the small place of the same name between Guadalajara and Lake Chapala.

Huichol, Territoire, Jalisco. See Nayarit, Sierra de.

Huicholes, Sierra de los (Diguet, Hartweg, Philbrick, Rose). AGS, 23-104c, 22-104a.

Huizaches, Los, Jalisco (Rzedowski). Not located on a map; said to be about 14 km southwest of Pihuamo.

Huizontla, Michoacán (Hinton). Huitzontla of AGS, 19-103c. Listed by Hinton as in "Distr. Coalcomán," but actually in the Mpio. de Chinicuila.

Ibarra, Barranca de, Jalisco (Barnes & Land, Collins & Kempton, Jouy, Palmer, Pringle, Reko, Sheldon). A *barranca* of the Río Grande de Santiago, just north of Guadalajara; see Asa Gray Bulletin II, 1: 389. 1953, or see map above, page 322. Also called Barranca of Portillo. Jouy collected birds here on several occasions.

Ingenio, Hacienda de, Nayarit (Gregg). Not located, but according to Gregg 18 or 20 miles nearly northwest of Tepic, on the road to the river-crossing at Santiago.

Ingenio, Río, Nayarit (McVaugh). AGS, 22-105c. Collections were made here on 8 July 1957, near the hydroelectric plant on a road that turned west off the highway 8 km north of Otates (27 km north of Tepic).

Isote, El. See Izote.

Itzicán, Jalisco. Not located; cited by Martínez (1948, p. 265), as "Itzicán, Poncitlán"; possibly this refers to a point north of Lake Chapala, between San Pedro Ixicán and Poncitlán (see AGS).

Ixtapa, Jalisco (McVaugh, Nelson). AGS, 21-105c. See Goldman (1951, p. 172).

Ixtlahuacán de los Membrillos, Jalisco (Detling, Norman). AGS, 20-103a.

Ixtlahuacán del Río, Jalisco (Cronquist, McVaugh, Puga). AGS, 21-103c.

Ixtlán, Nayarit (Ferris, Gregg, Jones, King, Viereck). Ixtlán del Río of AGS, 21-104a. Yxtlán del Río, q.v., of Mrs. Mexia. "Los Guajes, Ixtlán del Río," is cited by Martínez (1948, p. 313).

Izote, El, Jalisco (Correll, McVaugh). A village on the northwestern slopes of the Nevado de Colima at about 2500 meters. Erroneously spelled Isote by Correll and McVaugh.

Izotes, Rancho de los, Nayarit (Mexia). West of Tepic, q.v., on the road to Jalcocotán.

Jacala, Jalisco (Nelson). Jacal of AGS, 20-105b. See Goldman (1951, p. 172). Also spelled Jacoba.

Jacona, Michoacán (Cutler, Iltis). AGS, 20-102c.

Jaguay, Arroyo del, Jalisco (Mexia). Near Real Alto, q.v.

Jala, Colima (Hitchcock). AGS, 19-104b.

Jala, Nayarit (Collins & Kempton, Muller). AGS, 21-104a. See also Arroyo del Espino, and Juanácata.

Jala, Sierra de, Jalisco. See Lagos.

Jalapillo, Jalisco. See Mascota.

Jalcocotán, Nayarit (Ferris, McVaugh, Mexia). AGS, 21-105a. See Tepic.

Jalisco (various collectors). The name "Jalisco," when used without modification or explanation as a geographical name, may refer to the present state of that name, to some part of the present state of Nayarit (which was formerly associated politically with Jalisco), or to the settlement of Jalisco, Nayarit, a few kilometers from Tepic. For specific localities see the present account under names of individual collectors.

Jalisco, Nayarit (Barclay, Beechey, Ferris, Gentry & Gilly, Lay & Collie, McVaugh, Palmer, Sinclair). AGS, 21-105b. Always spelled Talisco in the *Botany of Captain Beechey's Voyage.*

Jalostotitlán, Jalisco (McVaugh). AGS, 21-102a.

Jalpa, Zacatecas (McVaugh). AGS, 22-103c. My collections from the summits between Jalpa and Tlaltenango (December 1970) were from a locality about 15 km south of Cerro Morones, q.v.

Jayamita, Colima (Jones). Not located, but evidently in this state because Jones' diary for July 1, 1892 indicates that it was a relatively short trip from the city of Colima. Cited as Jayamita, Jalisco in Contr. U.S. Nat. Herb. 20: 215. 1917.

Jazmín, Jalisco (Cronquist, McVaugh). AGS, 20-104d. A village at about 1500 meters, northwest of the Nevado de Colima; visited November 25, 1952, enroute from Autlán to Tonaya, Totolimispa and C. Guzmán.

Jazmines, Los, Nayarit (McVaugh, Pérez C.). AGS, 21-105b.

Jesús María, Nayarit (Feddema, Goldsmith, Norris, Philbrick). AGS, 22-104a. From Tepic Goldsmith made a trip northeastward across country to Guaynamota, via Pochotitán and Coyoltita. He ascended the Río Jesús María and collected (some plants but chiefly ethnological materials from the Cora and Huichol Indians) at Los Bules, Jesús María, Santa Rosa, Santa Bárbara, Santa Clara and La Mesa.

Jilotlán de los Dolores, Jalisco (McVaugh). AGS, 19-103a.

Jiquilpan, Michoacán (King & Soderstrom, McVaugh). AGS, 20-103d.

Jocotepec, Jalisco (Rowell). AGS, 20-103a. The Municipio of Jocotepec extends around the west end of Lake Chapala to San Juan Cozalá on the north shore and nearly to San Luis Soyatlán on the south; to the northwest it extends beyond El Molino, and it takes in most of the mass of Cerro Viejo.

Joya, La, Jalisco (Pringle, Ross). A locality, formerly a ranch, in the summit valley of the Nevado de Colima, north of the peak. See Davis (1936, p. 113), where called La Hoya.

Juana Burra, Nayarit (Goldsmith). Not located, but not over one day's journey from Los Bules, which is near the mouth of the Río Jesús María, q.v. Goldsmith collected at Los Bules, and elsewhere in the canyon of the Jesús María, on September 4, 1905, and at Juana Burra on the following day.

Juanácata, Nayarit (Mexia). Not located, but near Ixtlán del Río, q.v. Mrs. Mexia collected northeast of Ixtlán, on the road to Juanácata. Martínez (1948) makes various references to "Juanácata, Jala, Nayarit," which is doubtless the same place.

Juanacatic, Jalisco (G. Guzmán H.). AGS, 22-104b. A collection of *Quercus depressipes* is labelled "Juanacatic, El Plateado."

Juanacatlán, Jalisco (Barnes & Land, Cronquist, McVaugh, Pringle). AGS, 21-103c. Most of Pringle's specimens are marked Falls of Juanacatlan or Juanacatlan Falls, which is Salto Juanacatlán of AGS.

Juanacatlán, Puerto de, or Sierra de, Jalisco. See Laguna, La, and Mascota.

Juchipila, Zacatecas (Rzedowski). AGS, 21-103a. Juchipila lies in the river valley; Rzedowski collected on the nearby Cerro de Piñones, 4 km west of Pueblo Viejo.

Juchitlán, Jalisco (Anderson & Laskowski). AGS, 20-104a.

Junta, La, Jalisco (Hitchcock, Orcutt). Las Juntas of AGS, 21-103c.

Junta, Arroyo de la, Jalisco (Mexia). Near San Sebastián, q.v.

Juntas, Las, Río, Jalisco (McVaugh). A permanent mountain stream, Mpio. de Cabo Corrientes. Collections were made 10–13 km south and southwest of El Tuito, December 14–16, 1970.

Kings Station, Jalisco (Pringle). Kings of AGS, 21-103c. A railroad station southeast of Guadalajara.

Kiteni, Ravin de, ?Jalisco (Diguet). Not located, but said to be in the Sierra de los Huicholes, for which see AGS. See also Nayarit, Sierra de.

Labor, La, Nayarit (Collins & Kempton, Pennell). AGS, 21-105b.

Labra, Nayarit (Norris). A settlement of 3 huts, said to be about 15 miles west of Jesús María.

Lagos de Moreno, Jalisco (Hartweg, Johnston, McVaugh, Moore & Wood, Muller, Nelson, Weintraub). AGS, 21-102b. Commonly referred to as Lagos, as by Hartweg. Muller collected between Lagos and Encarnación de Díaz (An. Inst. Biol. [Méx.] 24: 260. 1954), and, like Mrs. Weintraub, between Lagos and Ojuelos. Moore & Wood collected between Lagos and Agua del Obispo. Martínez (1948, p. 85) cited "Sierra de Jala, Lagos." See also Ojuelos, Jalisco. Johnston collected between Encarnación de Díaz and Lagos, and between Lagos and León.

Laguna, La, Nayarit (Cronquist, McVaugh). A deep mountain lake north-northeast of Santa María del Oro, locally so-called. Shown (unnamed) on AGS, 21-105b, and on CARTA, Guadalajara 13Q-IV, 1957.

Laguna, La, Sierra de Juanacatlán, Jalisco (Nelson). Said to be about 10 miles northeast of Mascota (Goldman, 1951, p. 175). Probably the same La Laguna cited by Martínez (1948, p. 265).

Lake Chapala. See Chapala, Lago de.

Lalo, Cerro del. See Halo, Sierra del.

Laurel, El, Zacatecas (McVaugh). A very small settlement about 15 miles (25 km) southwest of Villanueva, Zacatecas, and near Huacasco, Jalisco.

Laurel, Sierra del, Aguascalientes (McVaugh & Koelz, Pippen, Rzedowski). AGS, 22-103d.

León, Guanajuato (Alamán, Hartweg, Méndez). AGS, 21-102b.

Lerma, Valle de, Michoacán or Jalisco (Pringle). Urbina (1897) cited certain collections, chiefly from the area of La Barca, in this way. The exact locality, if not stated, can usually be determined if the date is given, by reference to Pringle's journal (Davis, 1936).

Letras, ?Jalisco (Coulter). 8-10 km northwest of Ojuelos. See Coulter, in list of collectors.

Limón, El, Jalisco (Hernández X.). AGS, 20-104c. East of El Grullo.

Llano, El, Jalisco (Griffiths). Not located, but probably on the inner (eastern) uplands of Jalisco, nor far from a railroad line. Griffiths collected here September 16, 1909 (Contr. U.S. Nat. Herb. 14: 426. 1912). He was at "El Llego," which I take to be an error for El Llano, on September 19 (op. cit. 427). On September 28 he was in Durango, and on the 29th at Aguascalientes.

Llano, El, Nayarit (Hernández X.). Not mapped. South of Miramar, q.v.

Llano Grande, Jalisco (Feddema, Rzedowski). AGS, 20-105b. About 40 km northeast of Tomatlán.

Llego, El, Jalisco (Griffiths). Not located, but thought to be the same as El Llano, q.v. Reported in Contr. U.S. Nat. Herb. 14: 427. 1912, and op. cit. 17: 340. 1913.

Llorona, La, Jalisco (Correll). Not located on a map. On December 22, 1947, Correll travelled by auto from Zapotiltic to Jiquilpan, and made two collections, *Solanum inscendens* Rydb. (see U.S.D.A. Agric. Monog. 11: 29. 1952) and *Fuchsia parviflora* Zucc., at a locality which was called locally La Llorona. This is presumably somewhere in the pine forests near the summits west of Mazamitla, in the Sierra del Tigre, but the exact station was not recorded by Correll.

Lomas del Valle, Mpio. de Zapopan, Jalisco (Díaz Luna). The center of Zapopan is less than 10 km northwest of Guadalajara and the densely populated areas are almost contiguous, but the Municipio de Zapopan extends from the city northward two-thirds of the way to San Cristóbal de la Barranca.

Loreto, Aguascalientes (Rzedowski). CARTA, Zacatecas 13Q-II, 1958. About 15 km north of Aguascalientes.

Magdalena, Colima (Jones). La Magdalena of AGS, 19-104b.

Magdalena, Jalisco (Gregg, Muller, Pringle, Viereck, Waterfall). AGS, 21-104d. Muller collected east of this place, near the highway at km 750.

Maguey, El, Nayarit (Goldsmith). Not located, but said to be in the Sierra Madre of Tepic at 2500 feet elevation. Perhaps in the lower canyon of the Río Jesús María, near the country of the Cora Indians; see Goldsmith in the index to collectors.

Maguila, Michoacán (Emrick). A locality cited by Epling. Presumably this is a corruption of Maquilí, a place southwest of Aquila, and about one-third the way from Aquila to La Placita (cf. folded map in Brand, 1960).

Majada, La, Michoacán (Leavenworth & Hoogstraal). Near Apatzingán; not located.

Malpais, Nayarit (Gregg). Not the name of a locality, but the term used for the difficult broken terrain on the lava flows from Volcán Ceboruco, q.v.

"Manantlán, Purificación," Jalisco. Not located; cited by Martínez (1948, pp. 191, 305).

Manantlán, Jalisco (Crum, McVaugh, Wilbur). A ranch or group of ranches near large springs on the northern slopes of the Sierra de Manantlán, q.v. Also spelled Mamantlán. A locality cited by Emmet T. Hooper in Univ. Mich. Mus. Zool. Misc. Publ. 77: 235. 1952.

Manantlán, Sierra de, Jalisco (W. R. Anderson, Crum, McVaugh, Wilbur). This is the mountain-range shown (but not named) on AGS, 20-104c, slightly east of the line between Manzanillo, Colima, and Autlán, Jalisco, and somewhat nearer to the latter. In April, 1949, Wilbur and I collected on the northwestern slopes, having reached the area by pack-train from El Chante. A party of zoologists from the University of Michigan took part in the same trip, and the locality was later cited by Hooper (op. cit. 229) as "Sierra de Autlán." On my labels resulting from this trip the locality was cited merely as "about 15 miles southeast of Autlán."

In November, 1952, I went in to approximately the same area, but approached it by means of a lumber-road from Manzanillo. In Manzanillo the mountain-range was known, probably because of the name of the lumbering company which maintained the road, as Sierra de los Aserraderos del Pacífico. Persons on ranches in the mountains, however, called it Sierra de Manantlán. At the southern base of the range, in 1952, was a base-camp for the lumbering operations, called Durazno. From this point at an elevation of about 1000 m, the lumber road ascended very steeply by a series of switchbacks to a pass (called appropriately enough "La Cumbre") 10–11 km and 1000 m higher. From the pass the road continued over the range (so we were told) and down to a sawmill near Rancho Manantlán. We took instead a road that branched off toward the east, and continued to ascend, along the summits of the ridges, to a maximum elevation of about 2500 m by our altimeter. We collected along this road near a series of sawmills called San Miguel Uno (about 8 km east of the pass, at 2250 m), La Nevería (5 km further east, at 2500 m), and El Cuartón (16 km from the pass, at 2430 m). The latter lay over the divide to the north, not far above our base camp of 1949.

The road from Santiago via Durazno was washed out by the hurricane of 1959, and a new road was constructed to give access to the high ridges from the north. We entered in 1965 from El Chante, ascending gradually for about 15 km, then more rapidly up a narrow stream-valley, another 10 km to the pass ("La Cumbre") where the road down to Durazno (now abandoned) began to descend. We collected mostly near the high-southfacing cliffs about 16 km east of the pass (at 2700 m by our altimeter), and at various other points along the road as far as El Guadalupe (24 km from the pass) and El Guizar, 5 km nearer the pass and the current center of lumbering operations. We ultimately returned to La Cumbre and made our way down the unused but still passable road to the base of the escarpment at the site of Durazno, and on to Santiago via Cuzalapa.

Manzanilla, La, Jalisco (McVaugh). A small village on the southeastern shore of Bahía Tenacatita.

Manzanillo, Colima (Aguirre, Barclay, Beetle, Eyerdam, Ferris, Gilly, Hernández, Hinds, Hitchcock, Horton, Howell, Jones, Morrison, Orcutt, Palmer, Seler, Stadden, Stork, Trelease, West, Worth, Xántus). AGS, 19-104a. Many collections are labelled and/or cited as from Manzanillo Bay (Bahía de Manzanillo of AGS). The spelling Manzanilla was used by some British authors in citing the collections of Hinds, Barclay and Xántus.

María de Leon, La Mesa de, Jalisco. See Huejúcar.

Marqués, Cañón el, Michoácan (McVaugh). 8 km north of Nueva Italia. Río del Marqués is shown on AGS, east of Nueva Italia, 19-102ac.

Mascota, Jalisco (McVaugh, Nelson, ?Sheldon). AGS, 21-105d. "Puerto de Juanacatlán, Mascota," and "Jalapillo, Mascota," are cited by Martínez (1948, pp. 184, 256). See also Bufa, La.

Mata de Bule, Jalisco (Feddema, Rzedowski). See Corales, Sierra de los.

Matanejo, Jalisco. See Amatanejo.

Matanzas, Ejido de, Jalisco. See Ojuelos.

Mazamitla, Jalisco (Gregory & Eiten, McVaugh). AGS, 20-103c.

Mazatán, Nayarit (Feddema, Gentry & Gilly, Graber, McVaugh, Rzedowski). AGS, 21-105b.

Mazatepec, Jalisco (Dewey). AGS, 21-104d, as "San Isidro ó Mazatepec"; AGS, 1959. Also spelled Mazetepec.

Mazos, Los, Jalisco, See Tuxpan.

Mecatán, Nayarit (McVaugh). AGS, 22-105c.

Mesa, La, Nayarit (Goldsmith). See Mesa Nayar.

Mesa Nayar, Nayarit (Norris). Nayar of AGS, 1959, 22-105b, where shown as ca 7 km west of Jesús María. This is presumably the place called La Mesa by Goldsmith, q.v., and Mesa del Nayarit by Lumholtz (Amer. Mus. Nat. Hist. Mem. 3[Anthrop. II]: map between pp. 3 & 5. 1900). It is a principal town and religious center of the Cora Indians.

Mesa Redonda, Jalisco (McVaugh). An isolated, flat-topped mesa, prominent on the skyline about 15 km southwest of Lagos de Moreno. Apparently shown (unnamed) on CARTA, Querétaro 14Q-III, 1956.

Mesitas, Las, Jalisco (Mexia). Near San Sebastián, q.v. The specimen cited as from "entre Las Mesitas y La Estancia" by Martínez (1948, p. 305) is apparently Mrs. Mexia's no. 1900.

Mesquitec. See Mezquitic.

Mexicalcingo, Llano de, Jalisco (Bárcena). Several collections from this locality are cited by Urbina (1897). Not located, and possibly not actually in Jalisco, although the flowering dates of collections, as given by Urbina, suggest that the specimens were taken during periods when Bárcena was otherwise known to have been near Guadalajara.

Mexicaltzingo, Jalisco (Rzedowski). Not located on a map; north of Guadalajara on the highway to Ixtlahuacán del Río.

Mexpan, Nayarit (Gregg). AGS, 21-104a. Spelled Mezpa by Gregg.

Mezquital del Oro, Zacatecas (Cronquist, McVaugh). AGS, 21-103a.

Mezquitán, ?Jalisco (Oliva). There is a reference to "Mezquitan, Republic of Mexico" in Contr. U.S. Nat. Herb. 28: 224. 1929. There is a place of this name in Jalisco, possibly Oliva's locality, a few kilometers northeast of Autlán (AGS, 20-104c).

Mezquitic, Jalisco (Diguet, Feddema, McVaugh, Rose, Rzedowski). AGS, 23-104d. Also spelled Mesquitec, Mesquintec, Mesquitac, Mesquite, Mesquites. See Monte Escobedo for the route between this place and Mezquitic. In 1951 the truck road out of Mezquitic to the north ascended for about 19 miles (30 km) to the summit of a pass where the road to Huejuquilla el Alto branched off to the west; collections were made here April 17, 1951.

Michoacanejo, Jalisco (McVaugh). AGS, 22-103d.

Milagro, El, Jalisco (Feddema, Rzedowski). Not located on a map; said to be 10 km NE of Puerto Vallarta, in the Mpio. de Mascota.

Milpillas, Jalisco (McVaugh). AGS, 21-103c.

Mina de San Francisco, Jalisco (McVaugh). Almost due north of Autlán and west of Corcovado (cf. AGS) on a steep road 5 km above the valley highway. Collections were made in the oak zone and the transition to tropical deciduous forest, 1500–1800 m.

Mirador del Aguila, Nayarit (McVaugh). The site of a scenic overlook on the highway about 20 km north of Tepic. Collections were made in the deep wooded barranca below the highway to the east.

Miramar, Nayarit (Feddema, McVaugh). AGS, 21-105a.

Mirandilla, La, Jalisco (McVaugh). AGS, 20-105b. East and a little north of Talpa, across the mountains in the next river valley.

Mita, Punta, Nayarit (Howell). AGS, 21-106d.

Mixtlán, Jalisco (McVaugh). Between Estanzuela and Los Volcanes, visited April 30, 1951. CARTA, Guadalajara sheet, 1949. Also spelled Mixtán.

Mochitiltic, Jalisco (Gregg, McVaugh). La Venta de Nochitiltic of AGS, 21-104a, corrected to Mochitiltic in AGS, Index, p. 174. Also spelled Mochitilte.

Molino, El, Mpio. de Jocotepec, Jalisco (Jouy, McVaugh). AGS, 20-104b. Plant-collections were made in an area crossed by the highway, in rough low rocky hills, about 20 km northwest of the western end of Lake Chapala. Jouy collected birds here, at the site of the former hacienda, in 1892.

Monte Escobedo, Zacatecas (McVaugh, Rose). AGS, 22-104b. Also spelled Ecobedo, Escabado, Escobado, or Escolebo, with or without the word Monte. On April 16, 1951 I travelled by auto from this place to Mezquitic, Jalisco, by a road which ascended steeply to the ridge north of the town, crossed the level summit through the pine forest, and dropped precipitously to approach Mezquitic from the east.

Monte Oscuro, Jalisco (Mexia). Near San Sebastián, q.v. Also spelled Obscuro. What is apparently a second locality of the same name is cited by Martínez (An. Inst. Biol. [Méx.] 19: 75. 1948); it is said to be some 5 to 9 km from Cuale, at an elevation of about 1800 m.

Monteleón, Michoacán (Pringle). A railroad station just north of Monteleón of AGS, 20-102a. Also cited as Monte Leon Pass, Paso Monte León, or Paso de Monte León.

Morones, Sierra de los, Zacatecas (Gentry, Rose). The ridge which extends nearly south from Plateado. It is called Sierra Moroni by Goldman (1951, p. 288), q.v. for a description. The high point of the ridge, about 25 km south of Plateado and 15 km northwest of Jalpa, is Cerro Morones, 2686 m (CARTA, Guadalajara sheet, 1949). Specimens collected by Rose have been cited as from Los Morones.

Mortero, El, Rancho, Jalisco (Feddema, Rzedowski). ATLAS, hoja Zacatecas, 1944. About 2 km southeast of Mezquitic.

Moyahua, Zacatecas (Gwil Jones). AGS, 21-103a.

Muñeco, Cerro del, Jalisco. An alternative name, used by W. R. Anderson, for Sierra de Manantlán, q.v.

Naranjillo, Sierra, Michoacán (Hinton). "Distr. Coalcomán" according to Hinton but actually in Mpio. de Chinicuila.

Navarrete, Nayarit (Barclay, Nelson, Sinclair). AGS, 22-105c. See Tepic.

Navidad, Jalisco (McVaugh). AGS, 19-105b. See Barra de Navidad.

Navidad, Nayarit (Philbrick). In the Sierra de los Huicholes between Jesús María and San Andrés in the valley of the Río Chapalagana.

Navidad, Bahía, Jalisco (McVaugh & Koelz). AGS, 19-105b. The paved road to Autlán, completed between 1959 and 1965, turns abruptly north from the coast at the head of this bay. Collections were made in 1959 and 1960 at various points in the foothills north of this road-junction.

Nayarit, Sierra de (Diguet). Diguet's earliest collections (1896) labelled as from this locality are probably all from the "territoire de los huicholes," or Sierra de los Huicholes, somewhere southwest of Mezquitic, Jalisco; see AGS, 22-104a. See Diguet in the index to collectors.

A later collection made by Diguet, probably in the fall of 1897, was labelled "Sierra del Nayarit, partie occidentale," and may have been made in the Sierra de Nayarit of AGS, 22-105b, in the then territory of Tepic.

In the spring of 1900 Diguet probably crossed from Mezquitic to the westward, through the Sierra de los Huicholes and the Sierra de Nayarit to the valley of Río San Pedro and thence to Tepic.

A specimen collected by Arthur Schott on June 28, 1855, was reported as from "Sierra de Nayarit, Jalisco" (Ann. Missouri Bot. Gard. 24: 410, 413. 1937). On the day in question Schott was collecting in the Sierra del Pajarito, near the boundary between Arizona and Sonora.

Nevado de Colima. See Colima, Nevado de.

Nevería, La, Aserradero, Jalisco. See Sierra de Manantlán.

Nochistlán, Zacatecas. AGS, 21-103b. A locality several times cited by Martínez (1948). Also Sierra de Nochistlán (Martínez).

Nochitiltic. See Mochitiltic.

Nueva Italia, Michoacán (Feddema, McVaugh). AGS, 19-102c.

Oblatos, Barranca de, Jalisco (Barnes & Land, Collins & Kempton, Hitchcock, Langman, Moore & Wood). A *barranca* of the Río Grande de Santiago, just northeast of Guadalajara. See Asa Gray Bull. II, 1: 389. 1953, or see above, page 322.

Ocotal. See Ototal.

Ocote, Nayarit (Mexia). Near Ixtlán, q.v., and said in Mrs. Mexia's notes to be southwest of that place.

Ocotillo, El, Nayarit (Collins & Kempton, Gregg, Hartweg, McVaugh). AGS, 21-105b. The place of this name cited by Hemsley (Biol. Centr. Am. Bot. 3: 188. 1883) for a Hartweg collection is in Hidalgo, and the specimen to which he referred is no. 443 ("In monte Ocotillo, inter Real del Monte et Regla"; Benth. Pl. Hartw. 58. 1840).

Ocotlán, Jalisco (Furness, Gregg, Martínez, Nelson, Pringle, Rose & Hough). AGS, 20-103b. See also Goldman (1951, pp. 177–178). Also spelled Ocotlari.

Ocotoso, Cerro, Mpio. de Coalcomán, Michoacán (Madrigal S.). About 40 km west of Dos Aguas, q.v.

Ojocaliente, Aguascalientes (Rzedowski). AGS, 22-103d.

Ojos de Agua, Michoacán (Turner). Near the mouth of the Río Coahuayana, where Turner collected June 26–29, 1950.

Ojos de Agua, Nayarit (Mexia). Near Ixtlán del Rio, q.v. ATLAS shows a place called Ojo de Agua, 2–3 km southwest of Ixtlán.

Ojuelos, Jalisco (Coulter, McVaugh, Muller, Shreve, Weintraub). Ojuelos de Jalisco of AGS, 22-102d. Shreve's collection is cited as "near Ojuelos, Lagos" (Rhodora 51: 264. 1949). "Ejido de Matanzas, Ojuelos" is cited by Martínez (1948, p. 85). Muller and Mrs. Weintraub collected between Lagos and Ojuelos.

Orégano, Loma del, Jalisco (Mexia). Between San Sebastián and Real Alto, q.v.

Orendain, Jalisco (Jones, Rose & Hough). AGS, 21-104d. A railroad station near the junction of lines from Ameca and Tequila.

Orozco, Jalisco (Hitchcock). AGS, 21-103c. A railroad station southwest of Guadalajara.

Ortigal, Mpio. de Apatzingán, Michoacán (Hinton). Not otherwise located.

Ostula, Michoacán (Hinton, Turner). AGS, 18-103a. In the foothills, scarcely within our area. Turner came here by foot and horse from La Placita, July 13, 1950.

Ototal, El, Jalisco (Mexia). Said by Mrs. Mexia to be 2 leagues southwest of San Sebastián, q.v. Also called Hacienda del Ototal, and sometimes spelled Ocotal, Otolal, or Ototel. Local place-names recorded by Mrs. Mexia from this vicinity are: Arroyo de los Tapeistes, Arroyo de los Hornos, Arroyo de Ototal, Arroyo de los Palos Blancos.

Padercitas, Las, ?Colima (Kerber). Not located, but surely correctly spelled Padrecitas.

Padres, Rancho de los, Nayarit (Philbrick). In the Sierra de los Huicholes between La Vuelta and Rancho de Antonio, south-southeast of San Juan Peyotán.

Palma, La, Jalisco (Jones). About one half-day's trip from Tapalpa with pack-animals; see Jones, M. E., in the index to collectors. This is probably the place of this name about 8 km west-northwest of Tapalpa (Jalisco 1/100,000).

Palmas, Las, Jalisco (McVaugh, Mexia, Nelson). AGS, 21-105c, a little north of Puerto Vallarta. See Goldman (1951, pp. 172, 176). Goldman states that Las Palmas is northwest of San Sebastián; actually it is more nearly southwest.

Palmira, Cerro, Aguascalientes (Rzedowski). Collections were made on the south side of the mountain, said to be 4 km west of Asientos. The large mountain north of the highway in this position is named on many maps as Cerro Altamira. There is a mine called Palmira on the southern slope.

Palo Alto, Michoacán (Rzedowski). Not located on a map. In the Mpio. de Cojumatlán, near the line between Michoacán and Jalisco, south of Lake Chapala.

Palos Blancos, Arroyo de los, Jalisco (Mexia). Near Ototal, q.v.

Palos Verdes, Ojo de los, Jalisco (Pringle). North of the Nevado de Colima, and 3 miles west of the Rancho de los Seminitos, according to Pringle (Davis, 1936, p. 113).

Pascuales, Los, Colima (Rzedowski). AGS, 19-104d. On the coast, southwest of Tecomán.

Paso del Río, Colima (Emrick). AGS, 19-104d.

Patamban, Cerro, Michoacán (Nelson). Cerro Patamba of AGS, 20-102c; listed as Patambán in the index to AGS.

Patinar, Jalisco. See Platanar.

Patti hill, Michoacán (Pringle). Patti of AGS, 20-102a.

Pedro Paulo, Nayarit (Rose). A village said to be 22 miles east of Acoponeta (Goldman, p. 202). On Rose's labels the name was spelled as above, but correctly it is Pedro Pablo. Rose collected between this place and San Blasito ("Blascito"), a group of Indian ranches on the west side of Río San Pedro, an estimated 28 miles from Pedro Pablo (Goldman, p. 204). From San Blasito the road led to Aguacate and Dolores, qq.v. (Goldman, p. 202).

Pegueros, Jalisco (Hernández X.). AGS, 21-103d.

Peña Gorda, Jalisco (Mexia). Near Real Alto, q.v.

Pénjamo, Guanajuato. AGS, 20-102b.

Peribán de Ramos, Michoacán (McVaugh). AGS, 20-102c (index, but Periban on the map).

Picacho, El, Jalisco (Mexia). Near Real Alto, q.v., and perhaps the same as La Bufa.

Piedad, La, Michoacán (Cronquist, McVaugh, Pringle). La Piedad Cabadas of AGS, 20-102a.

Piedra Ancha, Jalisco (McVaugh). In 1949 a sawmill on the northern slope of the Nevado de Colima.

Piedra Rajada, Cerro, Jalisco. See Cuale, Sierra del.

Piedras Negras, Jalisco (Bárcena). Not located. A locality cited by Urbina (1897).

Pihuamo, Jalisco (Gómez, Jones, Koelz, Martínez, McVaugh). AGS, 19-103a. On some of Jones' labels the name of the state is given as Michoacán rather than Jalisco.

Pinos, Zacatecas (Diguet, Shreve). AGS, 22-102b. Usually called by Diguet Real de Pinos.

Piñones, Cerro de, Zacatecas (Rzedowski). Not located on a map; said to be west of Pueblo Viejo, a *ranchería* ca 15 km south-southwest of Juchipila.

Pitillal, El, Jalisco (Rzedowski). Not located on a map; said to be 2 km northeast of Puerto Vallarta.

Placita, La, Michoacán (Turner). A locality southwest of Aquila, on the ocean near the mouth of the Río Aquila, and said by Turner to be 45 air-miles south of the city of Colima. He came here on foot, from the mouth of the Río Coahuayana, June 30, 1950.

Plaluado. See Plateado.

Plan de Barranca, Jalisco (Gentry, McVaugh, Pringle). AGS, 21-104a; listed as Plan de Barrancas in the index. Pringle made an excursion, October 9–11, 1893, from Magdalena to Plan de Barranca, with intent to explore "the great barranca of the Tepic road" [for which see the localities called La Barranca, Nayarit (Jones), and Barrancas, Jalisco (Gregg)]. Some of the few specimens collected here by Pringle were cited by Urbina (1897) as from "Barranca de Tepic," and elsewhere as from the "Barranca of Tepic."

Plan de Lego, Jalisco (McVaugh). An active sawmill village (1970) in the Sierra del Halo, q.v.

Platanar, Jalisco (Bárcena, Cutler, Pringle). AGS, 19-103a. Said by Cutler to be on the railroad 53 km north of Colima. See also discussion by Goldman (1951, p. 178). Also spelled Patinar and Plantinar. Also Barranca de Platanar.

Platanar, El, Jalisco (Rzedowski). Not located on a map; a small village about 4 km west of San Martín de Bolaños. From El Platanar Rzedowski ascended into the mountains toward the northwest, for a distance estimated at 10 km, to Las Vidrieras, a place where there were some rainy-season shelters for the herdsmen. On the way there he passed Los Yerbanís and Las Treinta Vueltas.

Plateado, Zacatecas (Rose). El Plateado of AGS, 22-103a. Also spelled Plaluado.

Playa de Cuastecomate, Jalisco (McVaugh & Koelz). A small bay and surrounding hills, northwest of Bahía Navidad and separated from it by a rocky wooded headland. Since 1959 it has been accessible by a winding road 8 km long.

Playa de Oro, Colima (McVaugh, Rzedowski). Not located on a map; about 30 km west-northwest of Manzanillo.

Playa Grande, Jalisco (Rzedowski). Not located on a map; said to be 4 km northeast of Puerto Vallarta.

Pochotitán, Nayarit (Gentry, Goldsmith). AGS, 22-105d. Also spelled Pochotitlán.

Polanos. See Bolaños.

Pómaro, Michoacán (Hinton). AGS, 18-103a.

Poncitlán, Jalisco (Martínez, Rose & Hay, Rzedowski). AGS, 20-103b. See also Itzicán.

Portillo, Barranca of (Barnes and Land), Hacienda of (Palmer, Pringle). The Portillo hacienda was situated in the Barranca de Ibarra, north of Guadalajara; see Asa Gray Bull. II, 1: 387–388. 1953.

Poso Hedionda, Jalisco (Mexia). Near Real Alto, q.v.

Potrero de las Yeguas, Zacatecas (McVaugh). A small ranch near the road-summit, road to Mezquitic, about 25 km south of Valpararaíso.

Presa, La, Valle de Guadalajara, Jalisco (Bárcena). Not located on a map, but apparently one of the several irrigation-dams near the city. Variously cited by Urbina (1897): La Presa; Potrero de la Presa; La Presa (Guadalajara); or La Presa, Valle de Guadalajara.

Presa Calles, Aguascalientes (Shreve, Hooper). AGS, 22-102a. Hooper collected in the high mountains here called "Sierra Fría," west of the impoundment.

Presa de El Cuarenta, Jalisco (Reeder, Rzedowski). Not located on a map. In the Mpio. de Lagos de Moreno, ca 25 km northeast of Lagos.

Presa de Santa Rosa, Jalisco (McVaugh). A dam in the barranca of the Río Grande de Santiago, nearly north of Amatitán.

Primavera, La, Jalisco (Detling, Puga, Rzedowski). Not located on a map. Detling and Rzedowski collected near this place, at the source of the Río Salado. According to Rzedowski it is 30 km west of Guadalajara [i.e. not far from the junction of the railroad lines from Tequila and from Ameca], in the Mpio. de Tequila.

Pueblo Viejo, Zacatecas. See Piñones, Cerro de.

Puente Grande, Jalisco (Langman). CARTA, Guadalajara 13Q-(IV), 1957. 20–25 km southeast of Guadalajara, where the old highway to Lagos crosses the Río Grande de Santiago.

Puente San Pedro, Jalisco (McVaugh & Koelz). A highway bridge in a wooded gorge about 8 km southwest of Tecalitlán. See Sierra del Halo.

Puerto del Pinabete, Mpio. de Coalcomán, Michoacán (Madrigal S.). About 47 km west of Dos Aguas.

Puerto de la Paja, Zacatecas (Rzedowski). A name given to the high point on the road between Valparaíso & Huejuquilla.

Puerto de las Cruces, Michoacán (Rzedowski). Not located on a map. A high point on the road between Tepalcatepec and Coalcomán.

Puerto Vallarta, Jalisco (De Leon, Feddema, Howell, Lundell, Mexia, Rzedowski, G. B. Ross). AGS, 21-105c.

Puerto Zarzamora, Michoacán (Hinton). Zarzamora is listed on AGS, ca 10 km northwest of Coalcomán.

Puga, Nayarit (Feddema). AGS, 22-105d. On the railroad 10–12 km northeast of Tepic.

Punta, La, "District of Lagos," Jalisco (Shreve). AGS, 22-102d. North of Trojes and west of Chinampas.

Purísima, Hacienda de la, Jalisco. Near Guadalajara, according to Martínez (1948, p. 305).

Purucho, El, Michoacán (Hinton). Not located on a map. Often spelled El Parucho.

Quadrilla, Hacienda de la, Jalisco (Mexia). Near San Sebastián, q.v. Also called La Cuadrilla, or La Quadrilla.

Quelitán, Cerro de, Jalisco (collector unknown). A specimen of *Quercus laeta* Liebm. is labelled "Cerro de Quelitán, Mpio. de Atengo." See Atengo.

Quemada, La, Jalisco (Pennell). AGS, 21-104c. Pennell collected in 1935 in a locality which he called "Barrancas west of La Quemada, Jalisco"; see Barranca, La, Nayarit.

Quila, Jalisco. Cited by Martínez (1948, p. 155) as "Quila, Tecolotlán." Tecolotlán lies at the southeast base of the Sierra de Quila (AGS, 20-104a).

Quimixto, Jalisco (Mexia). Mrs. Mexia states that she reached this point from Puerto Vallarta "in a dug-out canoe by sea some twenty or thirty miles down the coast to a little cove named Quimixto inhabited only by seven very poor families." This is Qumiste (ATLAS, San Blas sheet, 1943) or Cumiste (CARTA, San Blas sheet, 1949), about 15 km south of Puerto Vallarta. On Negrete's map of Jalisco, 1/500,000, 1944, Quimixto is shown about 10 km south of Puerto Vallarta, but some distance inland.

Quitupan, Jalisco. AGS, 20-103d. See Cerro Santa María. Rzedowski made collections 12 km north of Quitupan, near the Jiquilpan-Manzanillo highway.

Ranas, Las, Nayarit (Philbrick). In the Sierra de los Huicholes between Jesús María and San Andrés in the valley of the Río Chapalagana. Said to be about "5 air miles" south of San Juan Peyotán.

Ranchito, El, Michoacán (Rzedowski). CARTA, Colima 13Q-VI, 1958, 19-104d. Said by Rzedowski to be in the Mpio. de Coahuayana.

Rancho Viejo, Jalisco (Rzedowski). Not located on a map; said to be in the Mpio. de Huejuquilla.

Real Alto, Jalisco (Mexia, Nelson). A former mining camp said by Goldman (1951, p. 179), to lie about 5 miles southeast of San Sebastián, near the summit of La Bufa,

at about 7200 feet elevation. Also cited as Real del Alto. Local place-names recorded by Mrs. Mexia from this vicinity are: Arroyo de las Canelillas, Poso Hedionda, Arroyo del Jaguay, Peña Gorda, El Picacho, Tajo de Santiago, Tranquillas.

Refugio, El, Nayarit (McVaugh, Muller). AGS, 21-105b. Southeast of Tepic, at the foot of Cerro Sangangüey.

Resolana, La, Jalisco (Crum, McVaugh, Wilbur). AGS, 20-104c. Now officially known as Casimiro Castillo, q.v. Wilbur and I camped in the lowlands 2 miles (3 km) north of here, April 7–8, 1949; later the same year Wilbur made additional collections in the same locality and also on the adjacent mountain slopes; see also Barra de Navidad. In 1949 the graded road, still under construction over the mountains from Autlán, ended near here.

Reyes, Los, Jalisco (Hartweg, Mexia). AGS, 21-105d. Near San Sebastián.

Reyes, Los, Michoacán (Cronquist, McVaugh, Nelson). AGS, 20-102c.

Rhaïmota, Ravin de, ?Jalisco (Diguet). Not located, but said to be in the Sierra de los Huicholes, for which see AGS. See also Sierra de Nayarit.

Rincón, El, Jalisco (McVaugh). A sawmill village (1960, 1965) in the river valley 12–13 km above (south of) La Mirandilla, at an elevation of 1500 m.

Rincón, El, Jalisco (McVaugh, Rzedowski). A small settlement about 13 km south of La Huerta, on the highway to Barra de Navidad, elev. ca 350 m.

Rincón de la Mesa, Jalisco (Martínez). Said to be some 5 to 9 km from Cuale, at an altitude of about 1800 meters (An. Inst. Biol. [Méx.] 19: 75. 1948).

Rincón de Mateo, Nayarit (Mexia). Near Ixtlán, q.v.

Rincón de Romos, Aguascalientes (McVaugh, Rzedowski). AGS, 22-102a.

Río Blanco, Jalisco (Barnes & Land, Gaiser, Palmer, Pringle, Rose, Rose & Painter, Trelease). About 15 km northwest of Guadalajara; see Asa Gray Bull. II, 1: 389. 1953, or see map above, page 322.

Río Santiago, Barranca du (Diguet). See Barranca, La, Jalisco.

Rosa, La, Nayarit. Cited by Martínez (1948, p. 313); possibly the same as Mesa de la Rosa, Municipio de Jalisco, Nayarit (op. cit. 267).

Rosas, Las, Hda., Jalisco. See Cerro de los Gallos.

Ruiz, Nayarit (many collectors). AGS, 22-105c. A railroad station at the crossing of the Río San Pedro, about 15 km east of Tuxpan, in the lowlands (elevation 55 m) north of our area.

Sacoalco, Jalisco (Jones). See Zacoalco.

Sahuayo, Michoacán (McVaugh). Sahuayo de Porfirio Díaz of AGS, 20-103b.

Salada, La, Colima (Rzedowski). Not located on a map. Said to be 22 km south of Colima on the highway to Manzanillo.

Salado, Río, Jalisco. See Primavera.

Salcillo (or Salsillo), Jalisco (Jones). See Saucillo.

Salitre, Michoacán (Rzedowski). AGS, 19-103c. On the road to Tepalcatepec, about 15 km north of Coalcomán.

Salto de Juanacatlán, Jalisco (Pringle). See Juanacatlán.

San Agustín, Jalisco (Pringle). AGS, 21-103c. Called San Augustin by Pringle (Davis, 1936, p. 115).

San Andrés, Jalisco (Langman, Pringle). AGS, 21-103c. Mrs. Langman collected east of Guadalajara, on the road to San Andrés.

San Andrés, Jalisco (Philbrick & Lewis). AGS, 22-104a. In the valley of the Río Chapalagana, said by Philbrick to be 20 miles [32 km] southeast of San Juan Peyotán. This is San Andrés Cohamiata of AGS, 1959.

San Antonio, Colima (Kerber, McVaugh, Seler, Reko). AGS, 19-104b. An ex-hacienda on the southwestern slopes of the Volcán de Colima. For a description see Goldman (1951, p. 136).

San Antonio, Jalisco (Sheldon). San Antonio Tlayacapán of AGS, 20-103a. A specimen of *Crotalaria eriocarpa,* in the Chicago Natural History Museum, is labelled "San Antonia, Lake Chapala." See Sheldon.

San Antonio, Jalisco (Gregg). A settlement northwest of Atequiza, not far west of the Salto de Juanacatlán. Mapped by Bárcena (1891, facing p. 262).

San Antonio, Zacatecas (McVaugh). A small settlement near the Jalisco line, 8–10 km southeast of Huejuquilla el Alto (ATLAS, Zacatecas sheet, 1944).

San Augustin, "Jalisco" (Liebmann). *Pectis liebmannii* was so reported in Proc. Amer. Acad. 33: 83. 1897 and, (as San Agustín), in Contr. U.S. Nat. Herb. 23: 1616. 1926. The locality is not in Jalisco, but near the Pacific Coast of Oaxaca. See also San Agustín.

San Bartolo, Hacienda de, Colima (Goldsmith). Not located, but said to be near Tecomán, q.v.

San Blas, Nayarit (Barclay, Beechey, Clarke, Coulter, Ferris, Galeotti, Hartweg, Hernández, Hinds, Lamb, Lay & Collie, LeJolis, Lundell, McVaugh, Maltby, Moore, Nelson, Philbrick, Roezl, Sinclair, Thibaud, Wright). AGS, 22-105c.

San Blascito, Nayarit (Rose). See Pedro Paulo.

San Cayetano, Nayarit (Pennell). AGS, 21-105b.

San Cristóbal, Jalisco (Cronquist, Diguet, McVaugh, Pringle). San Cristóbal de la Barranca of AGS, 21-103a. This is the place where the old road from Guadalajara to the north crosses the Río Grande. Diguet's specimens are labelled "Barranca de San Cristóbal," and Pringle's no. 3002, *Prionosciadium dissectum,* "between San Cristóbal and Guadalajara."

San Diego, Jalisco (Hartweg). Not located, but stated by Bentham (Pl. Hartw. 55. 1840) to be near Bolaños.

San Diego, Hacienda, Jalisco (Collins & Kempton). Near Cocula, q.v.

San Estéban, Sierra de, Jalisco (Barnes & Land, Pringle). A low arid range about 15 km northwest of Guadalajara; see Asa Gray Bull. II, 1: 389. 1953. Also called Sierra de Esteban or San Esteban mountains.

San Felipe de Hijar, Jalisco (Mexia). AGS, 21-105d.

San Francisco, Zacatecas (Rzedowski). Said to be in the Mpio. de Valparaíso.

San Francisco del Rincón, Guanajuato (McVaugh). AGS, 21-102b.

San Francisco de los Romos, Aguascalientes (M. C. Johnston). AGS, 22-102a.

Sangangüey, Cerro, Nayarit (Breedlove, Feddema, Muller). CARTA, hoja Guadalajara N-F-13 (IV), 1949, ca 18 km southeast of Tepic. The same elevation is shown, unnamed, between and north of El Refugio and La Labor, on AGS, 21-105b. Elevation 2354 m.

San Ignacio, Jalisco (McVaugh). CARTA, Guadalajara 13Q-(IV), 1957, listed as San Ignacio Cerro Gordo. A town at the eastern base of Cerro Gordo, q.v., 21-103d.

San Isidro, Jalisco (McVaugh & Koelz). An active sawmill village (1959) in the Sierra del Halo, q.v.

San Isidro, Nayarit (Feddema). Said to be 10 km east of Jesús María.

San Jacinto, Jalisco (Rzedowski). Said to be in the Mpio. de Poncitlán; not otherwise located.

San José, Michoacán (Rzedowski). Said to be in the Mpio. de Tomatlán, between Buenavista and Tepalcatepec.

San José, Nayarit (Rzedowski). Not located on a map; said to be in the Mpio. Valle de Banderas.

San José, Zacatecas (Rzedowski). Not located on a map; said to be 8 km south of Moyahua.

San José de Gracia, Aguascalientes (Rzedowski). Not located on a map; said to be near Calvillo.

San José de Gracia, Michoacán (McVaugh). CARTA, Colima 13Q-VI, 1958. About 35 km west of Jiquilpan, on the highway just before it passes into Jalisco. The relation between highway and town is not accurately shown on this map, but see AGS, 1959, 20-103a.

San José del Conde, Nayarit (Mexia). AGS, 21-105b.

San José de los Andrade, Jalisco (Hernández X.). "Near Volcanes & Talpa"; not otherwise located.

San Juan, Nayarit (Eisen). Not located; the reference is to "San Juan near Tepic" (Contr. U.S. Nat. Herb. 20: 11. 1917).

San Juan Capistrano, Zacatecas (Rose). AGS, 23-104c. Also cited as San Juan Campistrano.

San Juan, Cerro, Aguascalientes (McVaugh, Rzedowski). ATLAS, Edo. de Aguascalientes 1934, corr. 1961, 1:200,000. South of the highway between Tepezalá and Asientos.

San Juan, Cerro, Nayarit (Barclay, Collins & Kempton, Diguet, Gentry & Gilly, Hartweg, McVaugh, Mexia, Paray, Pennell, Sinclair). AGS, 21-105b. Also cited as San Juan mountain; see Tepic.

San Juan Cozalá, Jalisco (McVaugh & Koelz, Puga). San Juan Cosalá of AGS, 20-103a.

San Juan de Lima, Michoacán (Rzedowski). Near Punta San Juan de Lima, q.v. Absent from most maps, but appearing on maps 17 and 25 of the road-atlas called *Caminos de Mexico* (Hulera Euzkadi, S. A., México, ed. 3, 1967).

San Juan de Lima, Punta, Michoacán (McVaugh). AGS, 19-104d.

San Juan de los Lagos, Jalisco (McVaugh, Sessé & Mociño). AGS, 21-102a.

San Juan mountain, Nayarit (Barclay, Sinclair). See San Juan, Cerro.

San Juan Peyotán, Nayarit (Philbrick & Lewis). AGS, 22-104a. Philbrick and Lewis came to this place by air in 1957; see Philbrick.

San Leonel, Nayarit (Gregg). AGS, 21-105b.

San Luis Soyatlán, Jalisco (McVaugh). AGS, 20-103a.

San Luisito, Cuesta de, Nayarit (Goldsmith). Said to be in the Sierra Madre of Tepic, at an elevation of 4500 feet; from the sequence of dates and numbers in Goldsmith's collections, possibly in the upper canyon of the Río Jesús María, or along the route from Tepic to Pochotitán and Coyoltita.

San Marcos, Cuesta de, Jalisco (McVaugh & Koelz). Above and to the east of San Marcos (20-104b) of AGS.

San Marcos, Hacienda, Jalisco (Goldsmith, Jones, Jouy, Kerber, Pringle). San Marcos of AGS, 19-104b. Cited as "San Marcos, Tuxpan" by Martínez (1948, p. 178).

San Martín Hidalgo, Jalisco (collector unknown). AGS, 20-104b. Cited by Martínez (1948, p. 183).

San Martín de Bolaños, Jalisco (Rzedowski). AGS, 22-104d.

San Miguel de la Sierra, Jalisco (Cronquist, McVaugh). An important sawmill village since 1950 or before, apparently not on any map. It is about 40 km by road nearly west from Ayutla, in the pine forest at an elevation of 2000–2100 m. East of San Miguel the forest is prevailingly a dry oak-pine type; the elevation rapidly decreases toward Ayutla. From San Miguel well-used lumber roads lead to the south and southwest (cf. Santa Mónica), and to the northwest along the summits of the Sierra del Parnaso (AGS), with elevations mostly 2000–2350 m. The northern road led (1960, 1965) to El Carmen (12 km from San Miguel), La Cumbre (a sawmill village ca 25 km from San Miguel), and eventually (after descent into the valley east of the mountains), to La Mirandilla. The distance from La Mirandilla to San Miguel is about 55–60 km, over winding roads.

San Miguel I (San Miguel Uno), Aserradero, Jalisco (McVaugh). See Manantlán, Sierra de.

San Nicolás, Jalisco (Hitchcock). AGS, 20-104d. Between Sayula and Ciudad Guzmán.

San Nicolás, Río, Jalisco (McVaugh). AGS, 20-105c, southeast of Tomatlán.

San Patricio Melaque, Jalisco (Rzedowski). Not located on a map; a small settlement on the north side of Bahía Navidad.

San Pedro, Jalisco (Anderson, Bárcena, Hitchcock, Safford, Sheldon, Trelease). Tlaquepaque of AGS, 21-103c; also cited by Urbina (1897) as Llano de San Pedro, or San Pedro, Valle de Guadalajara.

San Sebastián, Jalisco (Mexia, Nelson). AGS, 21-105d. Mrs. Mexia's collections from this area bear many local names which do not appear on ordinary maps. All these are, as far as known, within walking distance, or easy riding distance, from San Sebastián: Arroyo del Triángulo, Hacienda del Cura, Arroyo del Cura, Arroyo Seco, El Ranchito, Arroyo del Ranchito (or Cañón del Ranchito), Arroyo de las Casillas, Arroyo Santa Gertrudis, Segundo Arroyo, Las Mesitas, Arroyo de las Casitas, La Junta Arroyo, La Cuadrilla, Taunas, La Estancia. On January 7, 1927, Mrs. Mexia collected nos. 1399–1417 near San Sebastián on the trail leading to Mascota. These have been cited as from "San Sebastián to Mascota," from which it may be inferred that she travelled over the whole distance to Mascota, which she apparently did not do.

Santa Ana, Jalisco (Bárcena, Pringle). On the lake bed 1 or 2 km southwest of Acatlán de Juárez of AGS, 20-104b. A railroad station of this name appears on the Guadalajara sheet, ATLAS, and, as Est. Sta. Ana, on CARTA Guadalajara 13Q-(IV), 1957. See also Davis (1936, pp. 115, 285), where Santa Ana is said to be seven hours by stage, or 30 miles, from Guadalajara. Most of the lowlands in this area have now been drained and planted to sugar-cane, and the native marsh species have almost disappeared.

Santa Bárbara, Nayarit (Goldsmith, Philbrick & Lewis). About 20 km southeast of Jesús María, and according to Philbrick 15 miles [24 km] south of San Juan Peyotán. In the Sierra de los Huicholes, not far from the Nayarit-Jalisco boundary, and sometimes shown in Jalisco (cf. Lumholtz, Amer. Mus. Nat. Hist. Mem. 3 [Anthrop. II]: between pp. 3 & 5. 1900).

Santa Catarina, Jalisco (Lumholtz). AGS, 22-104a. The United States National Herbarium contains some specimens collected by Lumholtz, an anthropologist, in October 1895.

Santa Clara, Jalisco (Goldsmith, Philbrick & Lewis). In the valley of the Río Guayavas, said by Philbrick to be about 15 miles [24 km] southeast of San Juan Peyotán. See map in Los Angeles Co. Mus. Contr. Sci. 68: 4. 1963. Presumably this is the place of this name visited by Goldsmith.

Santa Cruz, Jalisco (Jones, June 3–7, 1892). This is probably Santa Cruz of AGS, 20-104c. Jones states that to reach this place he travelled all day from Chiquilistlán [i.e. southwest] and stopped for the night at a ranch 6 miles east [i.e. east of Santa Cruz]. On leaving Santa Cruz he spent a day in the trip to La Palma, q.v., on the "worst road of all," in which he ascended 3000 feet, and descended 1500 feet.

Santa Cruz, Jalisco (Jones, June 13, 1892). Apparently Santa Cruz de Duque, q.v.

Santa Cruz de Duque, Jalisco (Bárcena). An hacienda from which Urbina (1897) cites more than 12 collections made by Bárcena; it is also cited as "Santa Cruz, Valle de Túxpan." This locality was visited by Bárcena on October 16, 1886, the day after the conclusion of a visit to Zapotlán; according to a description published by Bárcena, the hacienda was watered in part by the Río Covianes [Tuxpan] (Bárcena, 1891, pp. 342, 349, 460). Marcus E. Jones spent a night at a place called Santa Cruz, which he reached after passing the Río Covianes on the road between Zapotiltic and Tamazula, and presumably this is also Bárcena's locality, near the river and not far below Tamazula de Gordiano. The geographical position given by Bárcena for Sta. Cruz de Duque, however (1891, p. 223), appears to be in error.

Santa Cruz de las Flores, Jalisco (McVaugh). AGS, 20-103a. About 30 km southwest of Guadalajara.

Santa Cruz de Vallarta, Jalisco (Mexia). Near Puerto Vallarta, q.v. In Mrs. Mexia's notes the elevation is given as 300 meters. See also Cruz de Vallarta.

Santa Cruz, Valle de Ahualulco (Bárcena). Santa Cruz of AGS, 21-104c. Also Cerro de Santa Cruz, Valle de Ahualulco. Santa Cruz was the site of an hacienda which was also called Santa Cruz de Ahualulco.

Santa Cruz, Valle de Tuxpan. Same as Santa Cruz de Duque, q.v.

Santa Gertrudis, Nayarit (Rose). Not located on a map, but between Dolores and Santa Teresa, qq.v. For description of the locale, and of Rose's route, see Goldman (1951, p. 202). Not to be confused with Santa Gertrudis of AGS, 22-104a, which is in Jalisco.

Santa Gertrudis, Arroyo de, Jalisco (Mexia). Near San Sebastián, q.v.

Santa María, Cerro, Michoacán (Feddema). An isolated mountain said by Feddema to lie 8–10 km southwest of Jiquilpan and ca 5 km northeast of Quitupan, Jalisco.

Santa María del Oro, Nayarit (Gentry, McVaugh, Pennell). AGS, 21-105b. Since about 1958 a new graded road beyond Santa María has provided access to the deep lake among the mountains to the northeast. See La Laguna.

Santa María de los Angeles, Jalisco (Coulter). AGS, 22-103a.

Santa Mónica, Jalisco (McVaugh). The site of a sawmill 40 to 50 km (airline) southwest of Ayutla (Lat. approx. 20° N., long. 104°30′ W.). It is about 75–80 km by road from Ayutla, via San Miguel de la Sierra (40 km); a sawmill called La Cañada in an open valley of pine and zacatón (12 km); a sawmill called Agua Blanca beyond and below a high pine-covered ridge (12 km), and a final steep pine-covered ridge (12 km). Santa Mónica is said locally to be west of Santa Rosalía, and is probably about where Santa Rosalía appears to be on CARTA, Guadalajara 13Q-(IV), 1957, or a little south or southwest of that.

Santa Rosa, Nayarit (Goldsmith). AGS, 22-104a. Near Jesús María, q.v.

Santas Marías, Cumbres de, Jalisco. Said to be some 5–9 km from Cuale, at an elevation of about 1800 m (Martínez, An. Inst. Biol. [Méx.] 19: 75. 1948).

Santa Teresa, Nayarit (Rose, Seemann). AGS, 22-105b. For description and itinerary see Goldman (1951, p. 202–203).

Santa Teresa, Hacienda de, Zacatecas (McVaugh). Santa Teresa of AGS, 22-104b.

San Thoma, or San Toma. See Santo Tomás.

Santiago, Colima (Koelz, McVaugh). AGS, 19-104a. On Bahía Santiago, the western part of Bahía Manzanillo.

Santiago, Nayarit (Gregg, Lamb, Mexia). Santiago Ixcuintla of AGS, 22-105c. In the lowlands at our northern limits.

Santiago, Río Grande de. See Barranca, La, Jalisco.

Santo Domingo mines, Jalisco (Pringle, Shaw). Between Etzatlán and Ameca; see Davis (1936, p. 223).

Santo Tomás, Jalisco (Sessé & Mociño). AGS, 21-104a. Also San Toma or San Thoma. See Hostotipaquillo.

Sauces, Los, Jalisco (McVaugh). A small ranch about 15 km south of Talpa, at the foot of the mountains where a little-used road to San Miguel de la Sierra turned eastward (1960).

Saucillo, Jalisco (Jones). AGS, 20-104b. This is apparently the place called by Jones Salcillo (or Salsillo); it is a settlement about 10 km north of Chiquilistlán, in the same river valley.

Saucillo, Jalisco (Pringle). CARTA, Guadalajara sheet, 1949, 21-104a. Near the highway about 5 km east of Plan de Barranca. Pringle collected here on October 11, 1893, on his return trip to Tequila, but the place is not mentioned in his published journal.

Sayula, Jalisco (Collins & Kempton, Holway, Jones, Pringle, Sessé and Mociño). AGS, 20-104d.

Sayulapa, Jalisco (Correll). Stated by Correll to be on the "Volcán de Nevada" (U.S.D.A. Agric. Monog. 11: 231, 232. 1952). A settlement on an old road (now almost abandoned) between Jazmín and Ciudad Guzmán, Sayulapa lies on the high ridge north of the Nevado de Colima, 2–3 km north of the present road from Jazmín to Atenquique; see also Atequizatlán.

Seco, Arroyo, Jalisco (Mexia). Near San Sebastián, q.v.

Segundo Arroyo, Jalisco (Mexia). Near San Sebastián, q.v.

Seminitos, Rancho de los, Jalisco (Pringle). Stated by Pringle (Davis, 1936, p. 113) to lie at the north base of the Nevado de Colima.

Serrano, Jalisco (Seler). Not located, and possibly the assignment to Jalisco is an error, for there is a place called Serrano near the railroad line in Guanajuato, between Irapuato and Silao. A few numbers were collected by Dr. and Mrs. Seler on November 12, 1887, while they were traveling by rail from Chihuahua to Mexico City.

Sierra de los Morones, Zacatecas. See Morones.

Sierra de Nayarit. See Nayarit.

Sierra Fría, Aguascalientes (Hooper). See Presa Calles.

Sierra Madre, Durango (Rose). See Durango.

Sierra Madre west of Bolaños, Jalisco (Rose). Rose accompanied Nelson and Goldman for a distance said to have been about 14 miles, along a northwesterly course from Bolaños, to some caves near the summit of the mountains; see Goldman (1951, p. 180). Hartweg made a similar excursion from Bolaños.

Sierra Madre, Tepic (Rose). Specimens cited in this way were collected for the most part near Santa Teresa, Nayarit. See Goldman (1951, p. 202).

Sierra Madre, Zacatecas (Rose). Some collections have been so cited and/or labelled. These were collected for the most part between Huazamota, Durango, and San Juan Capistrano, Zacatecas. See Goldman (1951, p. 288).

Singaita, Nayarit (Hernández X., Philbrick). Singayta of CARTA, San Blas 13Q-(III), 1957. 6–7 km east-northeast of San Blas.

Soyatlán, Jalisco. A locality at about 2200 meters elevation, about 20 km north of Ayutla, cited by Martínez (1948, p. 184).

Tabasco, Zacatecas (W. R. Anderson). On the highway about 15 km north of Jalpa.

Tacubaya, Jalisco (McVaugh). A small ranch on the grassland, near the Aguascalientes State line, on the road from Ojuelos to Aguascalientes (1958).

Tajo de Santiago, El, Jalisco (Mexia). Near Real Alto, q.v.

Talisco, Nayarit (Beechey). This is Jalisco, Nayarit, q.v. The spelling Talisco was used throughout the *Botany of Captain Beechey's Voyage*, presumably because of misinterpretation of the original handwirtten notes of collectors.

Talpa, Jalisco (McVaugh, Nelson). Talpa de Allende of AGS, 20-105b. See also Torreón.

Tamazula de Gordiano, Jalisco (Jones, McVaugh). AGS, 20-103c. Also called Tamazula.

Tancítaro, Cerro de, Michoacán (Hinton, Leavenworth & Hoogstraal, Longpre). AGS, 19-102a.

Tanque de los Rayos, Zacatecas (Rzedowski). Not located on a map. Said to be in the Mpio. de Valparaíso.

Tapalpa, Jalisco (Iltis, Jones, McVaugh). AGS, 20-104b.

Tapeistes, Arroyo de los, Jalisco (Mexia). Near Ototal, q.v.

Tapotla, Jalisco (Pringle). So cited in N. Amer. Flora 25: 251. 1911. This is a corruption of Zapotlán, q.v.

Taunas, Jalisco (Mexia). Near San Sebastián, q.v.

Tecalitlán, Jalisco (Martínez). AGS, 19-103a. Cited by Martínez (An. Inst. Biol. [Méx.] 25: 61. 1954, and 1948, pp. 184, 256, 266).

Tecatitlán, Colima (Karwinsky). Not located; cited in An. Inst. Biol. [Méx.] 23: 79. 1953, as "Tecatitlán, Municipio de Manzanillo, Col.," and the date given as 1827. Probably some error is involved; see Karwinsky in the index to collectors.

Tecolote, Nayarit (Collins & Kempton). Very near Tepic, q.v.

Tecolotlán, Jalisco (Gentry, McVaugh, Martínez). AGS, 20-104b. "Cerro de la Coronilla, Tecolotlán" (Martínez), cited in An. Inst. Biol. [Méx.] 25: 56. 1954.

Tecomán, Colima (Emrick, Goldsmith, Hitchcock, McVaugh, Murrill, Orcutt). AGS, 19-104d. Goldsmith collected at "Hacienda San Bartolo, Tecomán." Murrill collected "along Armerica [Armería] River near Tecoman." Also spelled Teccoman.

Tecomate, Jalisco (Gentry). AGS, 20-104c.

Tecomates, Los, Jalisco (W. R. Anderson). Said to be between La Huerta and Cuautitlán.

Tecomatlán, Jalisco (McVaugh). From local information (1949) this was understood to be Tecopatlán, and it was so reported. It is a settlement on the trail between El Chante and Manantlán, and Hooper (Univ. Mich. Mus. Zool. Misc. Publ. 77: 235. 1952) states that it is 2–3 miles northeast of the latter.

Tecuán, Sierra de, Jalisco (Puga). Municipio de Jocotepec, between Las Trojes, q.v., and Lake Chapala.

Tecuitata, Nayarit (Rzedowski). Not located on a map; said to be near Tepic, on the road to Jalcocotán.

Tehuantepec, Michoacán (Hinton). AGS, 19-103c.

Tejones, Sierra de los, Colima. See Carmen.

Tenacatita Bay, Jalisco (Elmore, McVaugh). Bahía Tenacatita of AGS, 19-105b. See La Manzanilla.

Teocaltiche, Jalisco (McVaugh). AGS, 21-103b.

Teosintes, Los, Jalisco (Collins & Kempton). See Amparo.

Tepalcatepec, Michoacán (McVaugh, Rzedowski, Sessé & Mociño). AGS, 19-103b.

Tepatitlán, Jalisco (Dieterle, Langman, McVaugh). Tepatitlán de Morelos of AGS, 21-103d. A specimen of *Cestrum porphyreum* in hb. Hamburg, collected by Schaffner, is from Tepatitlán, according to report (Candollea 6: 108. 1936).

Tepetate, Nayarit (Norris). A settlement west of Jesús María and said to be 4 miles from the peak called La Ciénaga, q.v.

Tepezalá, Aguascalientes (McVaugh, Rzedowski). AGS, 22-102a.

Tepic, Nayarit (Barclay, Beechey, Coulter, Diguet, Ferris, Galeotti, Gentry & Gilly, Goldsmith, Gregg, Hartweg, Hinds, Jones, Kluge, Lamb, Lay & Collie, McVaugh, Mexia, Nelson, Palmer, Pennell, Roezl, Sessé & Mociño, Sinclair, Viereck). AGS, 22-105d. Records of specimens cited merely as from Tepic should be credited with caution, because the present Nayarit (Estado) was formerly called Tepic, with the status of a territory, and many published records refer to specimens from the territory, but not from the city.

When Barclay visited Tepic in 1837 and 1838 he made many collections along the road from San Blas, which ran northeasterly to Huaristemba, then easterly to Navarrete and thence ascended to Tepic. He made a special excursion to Navarrete, December 21–26, 1837.

Hartweg spent the winter of 1845–46 exploring the country about Tepic,

visiting Cerro San Juan, Volcán Ceboruco (via Ocotillo and Uzeta), Compostela, Amatanejo and Los Reyes (the two last in Jalisco), and San Blas. See Hartweg in the index to collectors.

Collins and Kempton worked near Tepic for 5 days in 1923, making 1-day trips to Cerro de la Cruz, Fresno, Tecolote and Cerro de San Juan.

During Mrs. Mexia's visit in 1926 she made several short trips, each of less than a day, to localities near the city. The principal ones are Aguacates, Rancho de las Delicias, Calixcillo, Rancho de los Izotes (on the road to Jalcocotán), Cerro de la Cruz, Cerro de San Juan, Jalcocotán, road to Acayapa.

Marcus E. Jones spent 10 days in and near Tepic in February, 1927, and made short trips out to collect each day; descriptions of his trips, and of the country, may be found in his Contribution to Western Botany, no. 15: 115–118. 1929.

Tepic, Barranca de (Pringle). See Plan de Barranca.

Tepopote, Cerro, Jalisco (Puga). Said to be 30 km west of Guadalajara.

Tequepexpan, Nayarit (Clarke). AGS, 21-105b.

Tequezquitlán, Jalisco (McVaugh). AGS, 19-105b. See Barra de Navidad.

Tequila, Jalisco (Castillo, Diguet, Gregg, Griffiths, Langman, McVaugh, Martínez, Moore & Wood, Palmer, Pringle, Rose & Hough, Sessé & Mociño). AGS, 21-104d. Also Barranca de Tequila.

Tequila, Cerro [de], Jalisco (McVaugh, Pringle, Puga, Webster). AGS, 21-104d. Called by Pringle Sierra de Tequila, but in fact a prominent isolated summit.

Terreria, Jalisco. See Ferrería.

Tetitlán, Nayarit (Gregg). AGS, 21-105b.

Tierra Blanca, Jalisco (Gentry). A name used by Gentry for an area of predominantly whitish soil and surface rock, near the summit of the pass about 10 km southwest of Cocula, on the highway to Autlán.

Tigre, Sierra del, Jalisco (McVaugh & Koelz). AGS, 20-103c. Our collections were made at the eastern end of the range, just below Mazamitla.

Tingüindín, Michoacón (Nelson). AGS, 20-102c.

Tiristiran, Michoacán (Gregg). Between Cuto (cf. AGS) and Tecacho, by Gregg's reckoning 18 miles nearly west of Morelia (Gregg Diary & Letters 1847–1850. p. 307. 1944).

Tizapán el Alto, Jalisco (McVaugh). AGS, 20-103a.

Tizupan, Michoacán (Hinton). Not located on a map. The Río Tizupan empties into the Pacific not far west of 103° W. long.

Tlajomulco, Mpio. de, Jalisco (Rzedowski). According to Rzedowski's labels most of his plants from Cerro Viejo were taken in this municipio, but most of the mountain mass is in the Mpio. de Jocotepec.

Tlaltenango, Zacatecas (Coulter, McVaugh). AGS, 22-103c. See Jalpa.

Tlaquepaque, Jalisco (Langman). AGS, 21-103c. See also San Pedro.

Tomatlán, Jalisco (McVaugh, Rzedowski). AGS, 20-105c.

Tonalita, Jalisco (Orcutt). So reported in Contr. U.S. Nat. Herb. 29: 84. 1944. This is probably Tonilita of AGS, the first station north of the Colima state line on the railroad between Colima and Ciudad Guzmán.

Tonaya, Jalisco (Cronquist). AGS, 20-104d.

Tonila, Jalisco (Bárcena, Jones, Reko, Seler, Sessé & Mociño). AGS, 19-104b. A report of a collection here by Uhde (Pflanzenreich IV. 83: 103. 1909) is probably erroneous. Seler collected in "Barranca de Tonila," and Bárcena in "Valle de Tonila."

Tonilita, Jalisco (Cutler, Reiche). AGS, 19-103a. See also Tonalita.

Torrecillas ["Torricillas"], Sierra, Michoacán (Hinton). In the Municipio de Coalcomán.

Torreón, Cerro de, Jalisco (Azcón). Cited by Martínez (1948, p. 266) as "cerca del Desmoronado, Talpa." Desmoronado (AGS, 20-105b) is a mining settlement about 25 km southwest of Talpa.

Totolimispa, Jalisco (Cronquist, McVaugh). AGS, 20-104d.

Tototlán, Jalisco (McVaugh). AGS, 21-103d.

Tranquillas, Jalisco (Mexia). Near Real Alto, q.v.

Trapiche, El, Nayarit (Mexia). Vicinity of Ixtlán, q.v., and said by Mrs. Mexia to be southeast of that place.

Trapichillo, Nayarit (Pennell). El Trapichillo of AGS, 22-105c.

Triángulo, Arroyo del, Jalisco (Mexia). Near San Sebastián, q.v.

Treinta Vueltas, Las, Jalisco. See Platanar.

Trojes, Jalisco (Puga). Las Trojes of CARTA, Guadalajara 13Q-(IV), 1957, and AGS, 1959. South of Guadalajara, 20-103a. Several of Sra. de Puga's collections are labelled "Sierra de Tecuán, Trojes."

Trojes, Jalisco (McVaugh, Muller). AGS, 22-102d. Also called locally La Troje; called by Muller Puerto de Trojes, and by McVaugh Paso de la Troje; this is where the road from Aguascalientes to Ojuelos drops abruptly from the high plain into the valley of Ciénega de Mata.

Tromptero, Colima (Kerber). Not located; see Colima, Colima.

Tuito, El, Jalisco (W. R. Anderson, McVaugh, Pérez J.). AGS, 20-105a.

Tula, Jalisco (Shaw). Same as Ferrería de Tula, q.v.; also cited as Tula by Martínez (1948, pp. 140, 155).

Tuxcacuesco, Jalisco (E. Anderson). AGS, 20-104d.

Tuxcueca, Jalisco (McVaugh, Navarro). AGS, 20-103a. There is a citation in An. Inst. Biol. [Méx.] 24: 241. 1954, of "Cerro de García, Tuxcueca."

Tuxpan, Jalisco (Bárcena, Barnes & Land, Diguet, Jones, Orcutt, Pringle, Purpus). AGS, 20-103c. Not to be confused with Tuxpan, Nayarit (AGS, 22-105c), where Mrs. Mexia collected in November, 1926, and which is outside our limits; through an error in labelling, some of her specimens have been cited as from Tuxpan, Jalisco. Diguet collected at "Río de Tuxpan," and Bárcena in "Valle de Tuxpan." "Los Mazos, Tuxpan" is cited by Martínez (1948, pp. 140, 178, 191, 223, 258).

Tuxpan Canyon, "Colima" (Orcutt). The railroad from Tuxpan to the city of Colima follows the canyon of the Río Tuxpan down about to the Colima state line before turning west toward the city. Specimens collected in the canyon by Orcutt were probably taken near the railroad, and perhaps in Jalisco rather than Colima.

Unión de Tula, Jalisco (McVaugh). AGS, 20-104a.

Usmajac, Jalisco (McVaugh). A village at the south end of Lake Sayula, east of Sayula.

Uzeta, Nayarit (Hartweg). AGS, 21-105b.

Valencia, Jalisco (Hitchcock). AGS, 20-104b. A railroad station northwest of Acatlán de Juárez.

Valle de Banderas, Nayarit (Nelson, Rzedowski). AGS, 21-105c.

Valparaíso, Zacatecas (Anderson & Laskowski, McVaugh, Rzedowski). AGS, 23-104d.

Varas, Las, Nayarit (Gentry & Gilly, Graber, McVaugh). AGS, 21-105a. As late as 1960 this place was accessible only by a steep narrow road descending from Mazatán. The paved road from Puerto Vallarta to Tepic now goes farther north, bypasses Mazatán and comes into Compostela from the west.

Veltran, Barranca de. See Beltrán.

Venta, La, Jalisco. Cited by Martínez (1948, p. 305). Possibly La Venta of AGS, a railroad station west of Guadalajara; see Astillero. Sierra de la Venta, said to be 25 km west of Guadalajara, is a locality where Sra. de Puga collected.

Venta, La, Lake Chapala, Jalisco (Lemmon). Not located; I have not found any place of this name near Lake Chapala, and possibly there is some confusion of localities, e.g. with the railroad station near the former Venta del Astillero; see Astillero.

Verde, Río, Jalisco (McVaugh & Koelz). Río Verde Grande or Río Belem of AGS, 21-103d. Collections were made on several occasions in the barranca where the road to Yahualica crosses, about 25 km north of Tepatitlán.

Verdura de Javiel, Jalisco. Said to be some 5 to 9 km from Cuale, at an elevation of about 1800 m. (An. Inst. Biol. [Méx.] 19: 75. 1948).

Vidrieras, Las, Jalisco. See Platanar.

Viejo, Cerro, Jalisco (Diguet, Gregory & Eiten, Rzedowski). Bola de Viejo of CARTA, Guadalajara 13Q-(IV), 1957. An isolated mountain rising to 2960 m, 10 km north of Jocotepec, 20-103a. Also called El Viejo.

Villa Alvarez, Colima (Rzedowski). Villa de Alvarez of AGS, 19-104b.

Villa Corona, Jalisco (Dieterle, McVaugh), AGS, 20-104b.

Villalpando, Guanajuato (Méndez). Villapando of AGS, 21-101a. A mine, still in operation, in the dry hills about 10 km east of the City of Guanajuato.

Villa Nueva, Zacatecas (Coulter, Cronquist, McVaugh, Seler). Villanueva of AGS, 22-103b. Reported in Pflanzenreich IV. 130: 292. 1930.

Villa Victoria, Michoacán (Hinton). CARTA, 13Q-VI, 1958. A little more than 20 km west of Coalcomán; apparently the same as Chinicuila of AGS, 19-103c.

Viudas de Oriente, Aguascalientes (Rzedowski). AGS, 22-102a.

Volcán de Colima, Volcán de Fuego, Volcán de Nevada. See Colima, Volcán de.

Volcanes, Los, Jalisco (McVaugh), AGS, 20-105b. A settlement on the regular road between Ayutla and Mascota. On April 30, 1951 I approached this place by another road, that from Estanzuela and Mixtlán. I then continued on the Mascota road to the Sierra de la Campana. Specimens cited as from "northwest of Los Volcanes" are from the Sierra de la Campana.

Vuelta, La, Nayarit (Philbrick & Lewis). In the Sierra de los Huicholes between Jesús María and San Andrés in the valley of the Río Chapalagana. Said to be about "5 air miles" [8 km] south of San Juan Peyotán.

Xeres, Zacatecas (Coulter). Ciudad García of AGS, 23-103c.

Yahualica, Jalisco (McVaugh, Weintraub). AGS, 21-103b.

Yerbanís, Los, Jalisco. See Platanar.

Yurécuaro, Michoacán (Pringle). AGS, 20-102a.

Yxtlán del Río, Nayarit (Mexia). Ixtlán del Río of AGS, 21-104a. Also Ixtlán, q.v., Yxtlan, or Yxtian. Mrs. Mexia spent about 10 days in this vicinity in 1926, and collected at the following localities near Ixtlán: Ojos de Agua; Rincón de Mateo; road to Barranca del Oro; Ocote; El Trapiche; road to San Marcos; La Cofradía; road to Juanácata.

Zacatecas (Rose). Some collections made in 1897 were so labelled and/or cited. For localities see Sierra Madre, Zacatecas.

Zacoalco, Jalisco (Bárcena, Dieterle, Jones). Zacoalco de Torres of AGS, 20-104b. Also spelled Sacoaco and Sacoalco. A collection by Bourgeau, reportedly from this place (Contr. U.S. Nat. Herb. 17: 283. 1913) is almost surely from the vicinity of Mexico City.

Zamora, Michoacán (Gregg, Muller, Nelson). AGS, 20-102c.

Zapatalan, Jalisco (Weber). Not located; reported in Contr. U.S. Nat. Herb. 3: 409. 1896.

Zapopan, Jalisco (Bárcena, Detling, Langman, Oliva). AGS, 21-103c. Also spelled Zapópam. See Zappan, and Lomas del Valle.

Zapotillo, Jalisco (Hernández X.). CARTA, Colima 13Q-VI, 1958. On the seaward slopes about 15 km (airline) southwest of Autlán, 20-104c.

Zapotitán, Jalisco (Gregory & Eiten). AGS, 20-103a.

Zapotlán, Jalisco (Bárcena, Correll, Goldsmith, Hitchcock, Holway, Jones, Pringle, Ross, Sessé & Mocino, Shaw, Trelease). The former name of Ciudad Guzmán. See AGS, 20-103c. Also spelled Tapotla, Tapotlan, Zapatlan.

Zapotlán, Laguna [de] (McVaugh & Koelz). AGS, 20-103c.

Zapotlanejo, Jalisco (Dieterle, Martínez). AGS, 21-103c.

Zappan, Jalisco (Galeotti). Reported in Mem. Nat. Acad. Sci. 20: 70. 1924. Evidently an error for Zapopan, q.v.

Zopilote, Nayarit (Lamb). AGS, 22-105d. Spelled Zopelote by Lamb.

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[N.B. The Guadalajara and San Luis Potosí sheets were re-issued in 1959, with many changes, not always for the better. Some new localities were added, and some improvements made, but many localities at which plants have been collected are no longer shown (e.g. Trojes and La Punta on the San Luis Potosí sheet, and more than 20 places on the Guadalajara sheet). The letters AGS following the name of a locality refer to the original editions; the re-issued sheets are cited as AGS, 1959.]

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CARTA [Primera edición]. Carta Geográfica de la República Mexicana. Escala 1:500,000. Issued 1956–1958, in 47 sheets, for the Comisión Intersecretarial Coordinadora del Levantamiento de la Carta Geográfica de la República. The following sheets pertain to Nueva Galicia: Mazatlán 13Q-I, Zacatecas 13Q-II, San Luis Potosí 14Q-I, San Blas 13Q-(III), Guadalajara 13Q-(IV), Querétaro 14Q-III, Colima 13Q-VI (printed on the same sheet with Tomatlán 13Q-V).

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MAPA de Nueva Galicia

10 0 10 20 30 40 50 60 70 80 90 100
KILOMETROS

COMPOSITARUM MEXICANARUM PUGILLUS

by

ROGERS McVAUGH

University of Michigan

CONTRIBUTIONS FROM THE UNIVERSITY OF MICHIGAN HERBARIUM
Volume 9, No. 4, pp. 359–484, 59 figures in text

University Herbarium, University of Michigan
Ann Arbor, Michigan
1972

Introduction

The comments and discussions that follow, the new names, and descriptions of taxa new to science, are presented as a necessary preliminary to a treatment of the family Compositae for a proposed *Flora Novo-Galiciana*. The area covered by the flora includes the Mexican States of Jalisco, Colima and Aguascalientes, and some adjoining territory; for fuller description of it see Brittonia 13: 145–147. 1961, or Contr. Univ. Mich. Herb. 9: 1–7. 1966.

In the preparation and publication of this manuscript I have been greatly aided by a grant (no. GB-5218X) from the National Science Foundation, which organization has also supported most of the field work connected with the Flora.

The type-specimens of Mexican Compositae are concentrated in relatively few herbaria, and it has been possible for me to see most of them. In this country I am particularly grateful to the authorities of the United States National Herbarium (US) and the Gray Herbarium of Harvard University (GH). For the loan of selected specimens including the types of species of *Pinaropappus* described by T. S. Brandegee I am indebted to the Herbarium of the University of California at Berkeley (UC), and for sending me a fine series of specimens collected in Chiapas, to Dr. Peter H. Raven. In Europe very many types of Mexican Compositae are to be found either at Kew (K), the British Museum (Natural History) (BM), the Muséum National d'Histoire Naturelle, Paris (P), or the Conservatoire Botanique, Genève (G). To the many persons at these and other institutions who have permitted and aided my studies of the valuable collections in their charge, my sincere thanks.

The Compositae treated in the following pages are arranged alphabetically by tribes, and by genera and species within the tribes. In Mexico the Helenieae comprise a distinctive series of genera, and I have somewhat reluctantly accepted the dictum of Cronquist and others that there is no sufficient distinction between the Helenieae and the Heliantheae.

Specimens cited below are in the Herbarium of the University of Michigan (MICH), unless otherwise indicated. The drawings are by Karin Douthit except as noted in the text.

Tribe I. Astereae

Achaetogeron subacaulis McVaugh, sp. nov.

Herba perennis pilosa, subacaulis, caudice lignoso brevi ramoso, caulibus 20–40 cm altis, simplicibus vel ramis 1–3 erectis subbasalibus instructis; folia rosularia plerumque conspicua subtus purpurascentia, plerumque lobata, oblanceolata, 5–10 cm longa (petiolo marginato incluso), 1–2 cm lata, lobis 1–3 quoque latere, acutis vel obtusis, 3–10 mm longis; folia caulinia basalia similia, superiora gradatim angustiora, caulis supra medium elliptica, oblonga vel linearia, sessilia, integra vel unidentata, 1–3 cm longa, 1–5 mm lata; capitula solitaria vel subsolitaria, multiflora, pedunculis 4–10 cm longis; involucrum mox rotatum, phyllariis 60–70, subaequalibus, 4.5–6 mm longis, lineari-lanceolatis, 0.4–0.8 mm latis, subglandulosis, marginibus angustis scariosis, apicibus attenuatis, subaristatis, plerumque purpureis; flores ligulati ca 90–100, ligulis albis 7–8.5 mm longis, 0.5–1 mm latis; disci flores flavi, corollis 2.8 mm longis; antherae (appendicibus angustis inclusis) 1.2 mm longae, basi obtusae; styli ramuli complanati, apicibus breve triangularibus papillosis; achaenia (immatura) elliptici-

FIG. 1. *Achaetogeron subacaulis* (*McVaugh 18434*, type). Flowering plant, X ½; flowering head with rays partly removed, X 2; ray-corolla, X 5; disk-corolla X 7.5; style-branches and anthers, X 12.5; achene, X 15.

oblanceolata, compressa, 1.3 mm longa, rare strigosa, apice sub pappo contracta, marginibus incrassatis; pappi setae ca 10 barbellatae, fragilissimae 0.5–1 mm longae, maturitate caducae; receptaculum convexum vel late conicum, 6–7 mm latum.

AGUASCALIENTES: Sierra del Laurel, near the Jalisco border, ca. 15–16 km [10 mi] SE of Calvillo, above Rancho de los Adobes, in oak forest, elev. 2500–2700 m, 26–28 Aug 1960, *McVaugh 18434* (MICH, type). Known only from the type-collection.

I find no other Mexican species to which this can be referred. The combination of perennial subscapose habit, usually lobed leaves, long-peduncled solitary heads, non-glandular pubescence (except for that of the obscurely glandular phyllaries), and the pappus of about 10 very fragile short bristles but lacking a crown, seems to be unique both in *Erigeron* and *Achaetogeron.*

Aster brevilingulatus (Hemsl.) McVaugh, comb. nov. *Psilactis brevilingulatus* Sch. Bip. ex Hemsl. Diagn. Pl. 2: 34. 1879. *Machaeranthera brevilingulata* (Hemsl.) Turner & Horne, Brittonia 16: 324. 1964.

In recent years students of the Mexican flora have increasingly tended to combine *Psilactis* and *Machaeranthera* under the latter name. Taxonomically it is about as difficult to keep *Psilactis* out of *Machaeranthera* as it is to keep the latter out of *Aster.* As there has been no general agreement on the limits of *Aster,* I have chosen for purposes of the *Flora Novo-Galiciana* to treat it in the broadest sense and include the other genera in it.

Aster spinosus Benth., var. **jaliscensis** McVaugh, var. nov.

A var. *spinoso* ramis plerumque foliosis non spinosis; phyllariis interioribus 18–22, prope medium plerumque latioribus, apicibus obtusis, membranaceis, usque ad 1 mm latis; pappi setis rigidis, inaequalibus 2–4 mm longis; achaeniis 2.5–4 mm longis, differt.

TYPE: NAYARIT: Among rocks in the stream above La Laguna, 3 km NE of Santa María del Oro, elev. ca 1000 m, 16 Sep 1960, *McVaugh 19049* (MICH).

Resembling *Aster spinosus* var. *spinosus,* but even the ascending broomlike flowering branches seldom producing spines, and most plants leafy at least below. In var. *spinosus* the inner phyllaries are 25–30, usually widest near base and tapering to a narrow, subacute tip; the pappus consists of very fine capillary bristles 4–6 mm long, and the achenes are 1.7–2.3 mm long. Var. *spinosus* is a plant chiefly of the Central Plateau of Mexico at elevations of 1500–2200 m, whereas var. *jaliscensis* is a plant of foothills on the Pacific Slope in southern Nayarit and western Jalisco, from near sea-level to about 1300 m.

NAYARIT: Compostela, *McVaugh & Koelz 649, Graber 15;* Santa María del Oro, *McVaugh 19049* (type), *23526.*

JALISCO: Las Palmas, *McVaugh 25562;* Quimixto, *Mexia 1206;* Mpio. de Cabo Corrientes, S of El Tuito, *McVaugh 25401;* Ayutla, *Cronquist 9780.*

Baccharis multiflora H.B.K. Nov. Gen. & Sp. 4: 59. 1820.

The taxonomy of the group including *Baccharis multiflora, B. sordescens* DC., and *B. serraefolia* DC., has not been very satisfactorily worked out. Material from Nueva Galicia would be referred to *B. serraefolia* on the basis of Blake's treatment in the Trees and Shrubs of Mexico, because the heads are smaller than in typical *multiflora* and the phyllaries are not purplish. In all our material, however, the leaves are pinnately veined as in *B. multiflora,* whereas *B. serraefolia* was originally distinguished by DeCandolle because of its short, triplinerved leaves. Until the group can be revised, it seems better to treat our material as part of an inclusive *B. multiflora.*

The first-known variety of the species, *B. multiflora* var. *multiflora,* ranges in the uplands from eastern Michoacán (*Hinton 13361*) and the central part of the State of Mexico ("juxta Tianguillo et prope urbem Tolucae," *Humboldt & Bonpland!*, the type, at P[1]), to Hidalgo, Puebla and Guerrero. Our specimens seem to belong to two populations that occupy ranges nearer the Pacific Coast, in the mountains from western Jalisco to Michoacán. The leaves are mostly longer and narrower than in the typical variety, and the pistillate heads are smaller and paler. The involucre in staminate plants of *B. multiflora* varies in length from 3.5–4 mm through most of the range of the species.

Baccharis multiflora H.B.K., var. **brevipappa** McVaugh, var. nov.

A var. *multiflora* caulibus robustioribus usque ad 4.5 m longis, capitulis minoribus fem. ca 15-floris, phyllariis plerumque non valde purpureis, pappi setis 4.5 mm longis (non 6–8 mm); capitulis masc. 12–13-floris, involucro 3–3.5 mm longo, differt.

TYPE: JALISCO: Headwaters of Río Mascota south of El Rincón, 20–25 km SE of Talpa de Allende, elev. 1700–1900 m, 3–4 Apr 1965, *McVaugh 23463* (MICH).

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[1]Abbreviations used for herbaria are those of the *Index Herbariorum* (ed. 5; Regn. Veg. 31: 1–251. Utrecht, 1964).

A weak, moderately tomentose shrub 1.5–4.5 m high, the leaves narrowly elliptic, (4–) 8–13 cm long, 1–3 cm wide, 5–8 times as long as wide.

JALISCO: Talpa de Allende, *McVaugh 23463* (type); Nevado de Colima, *McVaugh 10096.* MICHOACAN: Coalcomán, Dos Aguas, *McVaugh 22707;* Pátzcuaro, *Rzedowski 22149.*

Baccharis multiflora H.B.K., var. **herbacea** McVaugh, var. nov.

Perennis, caulibus 1 m altis, rhizomatosis, pubescentibus, vix tomentosis; folia elliptica 2.5–7 cm longa, 1–2 cm lata, 2–4-plo longiora quam latiora; capitula fem. ca 22-flora, involucro 5–5.5 mm longo, phyllariis ca 30, stramineis, pappo 5.5–6 mm longo; capitula masc. ca 16-flora, involucro 3.5–4 mm longo, phyllariis ca 30, eis capitulorum fem. similibus sed brevioribus, pappi setis 4 mm longis, apicibus subclavatis complanatis.

TYPE: MICHOACAN: Coalcomán, pine-fir forests on limestone, near summits ca 25 km SW of Aserradero Dos Aguas, nearly west of Aguililla, elev. 2400–2500 m, 6 Mar 1965, *McVaugh 22846* (MICH). Known only from the type collection.

Evidently herbaceous, sparingly pilose with brownish, many-celled hairs, the upright flowering stems 1 m high or less, from creeping rootstocks.

Conyza dentonae McVaugh, sp. nov.

Annua, diffusa, ramis patentibus vel decumbentibus 8–20 cm longis prope basin oriundis; planta floccoso-tomentosa, phyllariorum apicibus exceptis; folia caulinia, alterna, sessilia, basi auriculata, laminis oblongo-linearibus, obtusis vel subacutis, 1–2.5 cm longis, 2–6 mm latis, plerumque crispatis, marginibus paucidentatis; capitula solitaria vel pauca in quoque ramo, 4.5–5 mm alta, 8–9 mm lata (compressa), 100–150-flora, pedunculis 1–1.5 cm longis vel brevioribus; involucrum 4 mm altum, basi truncatum vel late rotundatum, phyllariis ca 35–40, mox rotatis vel reflexis, interioribus 30–35 subaequalibus, subscariosis, lineari-subulatis, 0.3–0.6 mm latis, marginibus anguste hyalinis, apicibus acutis, erosis, membranaceis, phyllariis exterioribus gradatim brevioribus 5–8, per lanam suboccultis; flores hermaphroditi 7–11, corollis 2.5 m longis; antherae appendicibus anguste triangularibus inclusis 1 mm longae, basi obtusae; flores feminei filiformes, 2 mm longi, ligulis angustis 0.2–0.4 mm longis instructi; achaenia 1–1.3 mm longa, 0.4 mm lata, subsericea, compressa, elliptico-oblanceolata, enervosa, prope apicem glandulosa; pappi uniserialis setae ca 15, graciles, albo-flavidae, 2–3 mm longae; receptaculum convexum, 2.5–3.3 mm latum, phyllariis post anthesin arcte reflexis circumcinctum.

Species eius inventori Melinda Fay Denton (1944–), Oxalidis aliarumque plantarum mexicanarum studiosae, nominavi.

TYPE: JALISCO: Heavily overgrazed nearly level grasslands near km 18, SW of Ojuelos on the road to Aguascalientes, elev. 2175 m, 15 Aug 1958, *McVaugh 16974* (MICH).

Distinguished from the other cottony-tomentose species of *Conyza* in our flora by the uniseriate pappus (pappus biseriate in *Conyza confusa* Cronq., *C. filaginoides* DC. and *C. gnaphalioides* H.B.K.) and by the short ligules (these 0.7–2 mm long in *C. confusa,* wanting in *C. filaginoides* and *C. gnaphalioides*). In *C. confusa* the leaves are green and glabrous or nearly so above; in *C. filaginoides* the flowers are only 40–50 in a head; in *C. gnaphalioides* the achenes are obovate and 1–1.4 mm wide.

JALISCO: Km. 18, SW of Ojuelos, *McVaugh 16974,* type.

ZACATECAS: 14 mi [ca 22 km] E of Sain Alto, *Shreve 9204;* 25 mi [40 km] NW of Fresnillo, *Waterfall 15594.*

Haplopappus venetus (H.B.K.) Blake, var. **hartwegii** (A. Gray) McVaugh, comb. nov. *Bigelovia hartwegii* A. Gray, Syn. Fl. N. Am. 1, pt. 2: 143. 1884.

Harvey Monroe Hall, the monographer of *Haplopappus,* maintained *H. venetus* and *H. hartwegii* as separate species. He seems to have seen little material from central Mexico, but to have based his interpretation chiefly upon specimens from areas to the north and northeast of Nueva Galicia. He described the corolla-lobes of *H. hartwegii* as

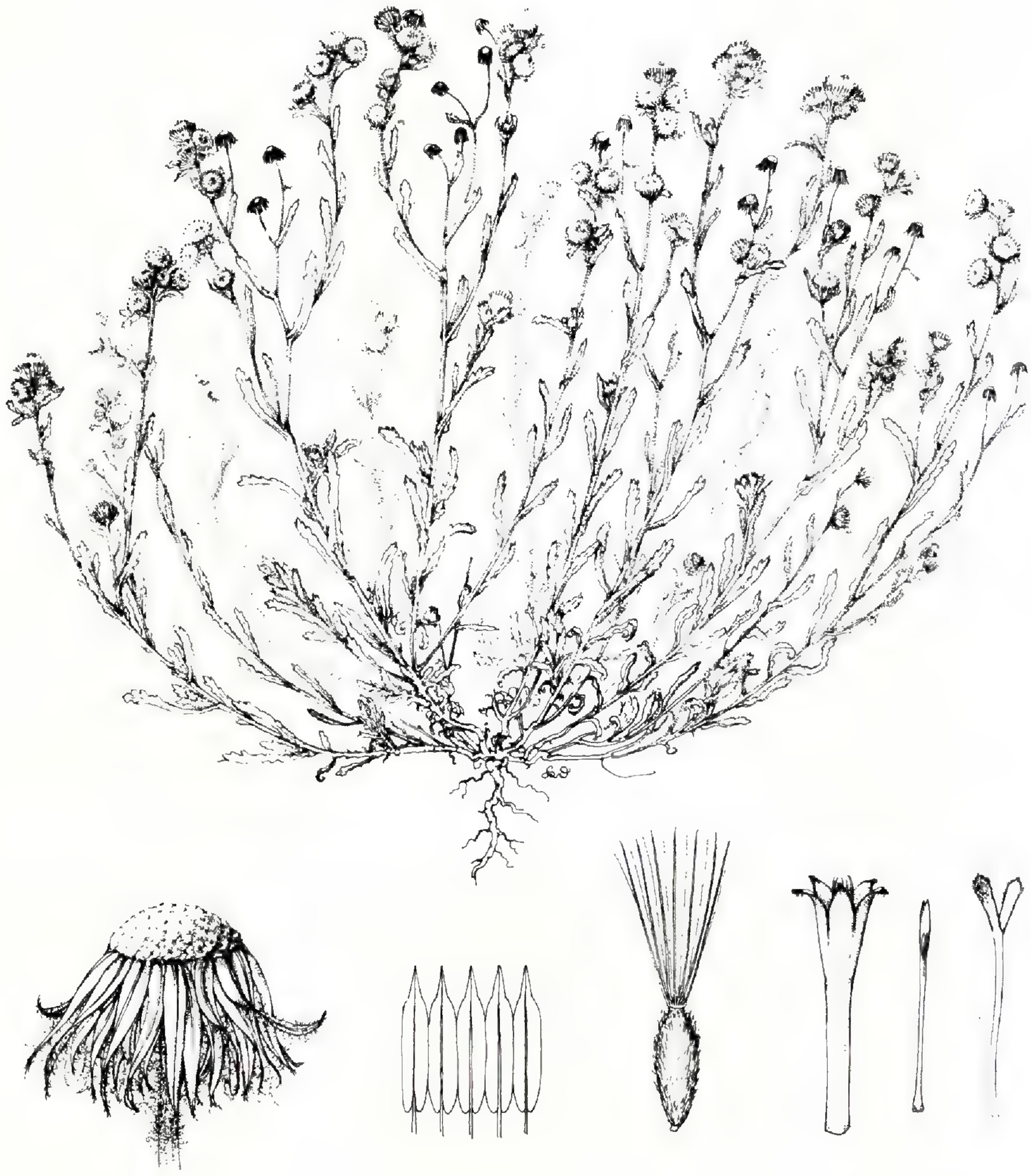

FIG. 2. *Conyza dentonae* (*McVaugh 16974*, type). Flowering plant, X ½; over-mature fruiting head, X 5; corollas, style-branches, achene, X 10; anthers X 15.

1–1.3 mm long; in the abundant material now available, the lobes are usually 0.6–0.8 mm long, whereas in typical *H. venetus* they average 0.7–0.9 mm long. In occasional plants of either variety they may be as much as 1 mm long. The leaves in the two varieties are noticeably different, those of var. *hartwegii* usually narrower and more definitely pinnatifid.

Solidago stricta Ait. Hort. Kew. 3: 216. 1789.

Among the plants recently collected in Chiapas by D. E. Breedlove are several specimens of a *Solidago* with nearly glabrous, virgate inflorescence, long entire basal leaves, and erect, narrow and sharply reduced upper cauline leaves. As apparently no species answering this description had ever been reported from this part of Mexico, the identification of the plant was of special interest. It transpires that a few other collectors have found the same plant in Chiapas, and a very similar one at a few lowland localities near the Atlantic coast of Mexico.

The plants thus occur in Mexico in two very different habitats. One group of specimens is from "steep moist slopes" or "bogs" in the moist forested mountains of

the interior of Chiapas, at elevations ranging from about 1000 to about 2100 meters. Two other specimens are from river-mouths in Veracruz and Tabasco, respectively, and thus grown under maritime conditions. I cannot separate the upland from the maritime plants, except that in the latter the involucres are very slightly longer (4–4.5 mm as against 3.5–4 mm), and in one specimen (*Purpus 6298*) the rays are as many as 11, whereas in the upland specimens the rays are usually 4–5 (or in *Breedlove 7108,* 5–8).

The upland plants are scarcely distinguishable from *Solidago stricta* of the southeastern United States, except that the specimens are more vigorous than usual, with slightly larger upper cauline leaves, and somewhat thicker, longer, inflorescences; the leaves are always scabrous-margined (in *stricta* usually but sometimes obscurely so), and the inflorescence is always slightly pubescent (in *stricta* rarely entirely glabrous, but usually obscurely pubescent).

Plants of the upland population are often 1 m high, with virgate or narrowly cylindrical inflorescence 15–20 cm long and 2–4 cm thick, or in more vigorous plants 30 cm long, 5–7 cm thick, with numerous strongly ascending and often revolute-secund branches 5–10 (–15) cm long; the leaves are all entire, glabrous and scabrous-margined; those of the basal rosette are obtuse, 15–20 (–35) cm long and 1.5–2 cm wide; the cauline leaves are numerous; those on the lower half of the stem are like the basal ones but shorter; the upper half of the stem below the panicle bears 10–20 more or less erect and appressed, lanceolate or elliptic and usually callose-pointed leaves 2–5 cm long, 2–5 mm wide; the branchlets of the panicle, and the peduncles, are minutely but evidently antrorsely hispidulous; the heads are 5–6 mm long, the ray-flowers and involucres as described above; the mature achenes are sparingly or rather densely pubescent, 1.5–2.2 mm long.

Specimens examined:

CHIAPAS: Without locality, *Ghiesbreght 124* (GH, with note by M. L. Fernald, "This is *S. stricta* Ait."); Ocuilapa, 21 Aug 1895, *E. W. Nelson 3006* (GH); Margaritas, Comitán, 6 Jun 1945, *E. Matuda 15801;* Mpio de San Cristóbal de las Casas, elev. 2100 m, 24 Aug 1964, *Breedlove 7180,* 3 Aug 1966, *Breedlove 14705;* Mpio. de Tenejapa, 30 Sep 1965, *Breedlove 12566* (DS), 28 Nov 1964, *Breedlove 7769,* 16 Jul 1964, *Breedlove 6525,* 14 Jul 1965, *Breedlove 11005;* Mpio. de Teopisca, 25 Jun 1965, *Breedlove 10540.*

Two Mexican specimens from maritime habitats, because the plants have slightly larger heads with more numerous flowers, are apparently referable to what has been called *Solidago sempervirens* var. *mexicana* (L.) Fernald. This variety, however, as recognized in current manuals and floras, seems about as closely similar to *S. stricta* as to *S. sempervirens,* and a reconsideration of specific limits in the entire group seems to be needed. Although many authors have separated *S. sempervirens* from *S. stricta* on the basis of maritime vs. non-maritime habitat, the morphological distinctions between them have never been very satisfactorily set forth.

Asa Gray (Syn. Fl. 1, pt. 2: 149-150. 1884) treated *Solidago mexicana* L. (Sp. Pl. 879) as a synonym of *S. sempervirens L.* (Sp. Pl. 878). He separated *S. sempervirens* from *S. stricta* Ait. as follows:

> Flowering rather early, commonly stout and middle sized or tall; general inflorescence paniculate or hardly strict, leafy at the base; upper leaves not notably unlike the lower ones and not appressed; inflorescence occasionally pubescent; rays 7–10; heads 4 or 5 lines long, or in slender forms only 3 lines long. *S. sempervirens.*
>
> Late-flowering, wholly glabrous, virgate, the upper portion of the stem beset with small appressed leaves; heads (commonly 3 lines long) in a strict and narrow naked panicle; rays 5–7. *S. stricta.*

Of *S. stricta* var. *angustifolia,* Gray went on to say "Forms in brackish soil not clearly distinguished from the most slender and narrow-leaved *S. sempervirens.*"

The original source of *Solidago mexicana* was unknown to Linnaeus, but he supposed it to have come from Mexico. A specimen in the Linnaean Herbarium (no. 998–13) bears large leafy bracts in the inflorescence, and seems on the basis of a

photograph to resemble *S. sempervirens* except that the heads may be slightly smaller than in the common *sempervirens* of the eastern United States. Fernald (Rhodora 37: 447–448. 1935) took up the Linnaean name, and recognized, as *S. sempervirens* var. *mexicana* (L.) Fern., a plant with "narrower leaves and smaller heads," and branches of the panicle "often hirtellous." He said also "Much of the southern material of var. *mexicana* has been misidentified as . . . *S. stricta* Ait. . . . [*S. stricta*], however, has a stoloniferous base, very reduced upper cauline leaves and quite glabrous inflorescence."

In *Gray's Manual* (ed. 8. pp. 1398–1399. 1950) Fernald emphasized that *stricta* was "glabrous throughout," the "rhizome horizontal or ascending, finally producing slender stolons," the involucres 4–5 mm high. He described *sempervirens* as having involucres 4–7 mm high, mature achenes 2.2–3.5 mm long, and the rays 8–10; var. *mexicana* was described as having the heads "slightly smaller," the branches "usually hirtellous," and the cauline leaves "frequently ciliolate."

According to Cronquist (in Cronquist & Gleason, Man. Vasc. Pl. 712. 1963), *S. sempervirens* var. *sempervirens,* with 12–17 rays, ranges as far south as Virginia, whereas var. *mexicana,* with 7–11 rays, and involucre 3–4 or occasionally 5 mm long, is southern. In the same publication *S. stricta* is described as having the involucre 4–6 mm long, and the rays 5–7.

The differences between the two species thus are seen to be mostly those of size of heads, number of rays, size of cauline leaves (especially relative to the basal leaves), and the presence or absence of stolons. The pubescence-character by itself is not very useful, as some specimens of *sempervirens* are essentially glabrous, but almost no specimens of *stricta* are completely destitute of the tiny antrorsely directed bristle-like hairs that occur on the peduncles and the small branchlets of the panicle.

The following specimens, like *sempervirens,* come from a maritime habitat. They are unlike that species, as usually described, in having very sharply reduced upper leaves (as in *stricta*), the achenes 2 mm long or less (as in *stricta*), and the branchlets very sparingly pubescent as in the upland Mexican representative of *stricta* (not "hirtellous" as in many North American specimens referred to *S. sempervirens* var. *mexicana*). As mentioned above they resemble *"S. sempervirens* var. *mexicana"* in having slightly larger heads than the upland plants from Chiapas, and because of the fact that the rays in one specimen are 11 in number.

VERACRUZ: Mouth of Río de la Antigua, Sep 1912, *C. A. Purpus 6298* (GH).
TABASCO: Mouth of Río Grijalva, Frontera side, 23 Apr 1963, *F. D. Barlow 19/1.*

Xanthocephalum gymnospermoides (A. Gray) Rothr., var. **eglandulosum** McVaugh, var. nov.

Annua, glabra glutinosaque, usque ad 1.5–1.8 m alta, a var. *gymnospermoide* ramulis pedunculisque eglandulosis differt.

JALISCO: Grassland 9 mi [14–15 km] S of Yahualica; seepage areas in wet mud, elev. ca 1860 m, almost past flower 6 Nov 1959, *McVaugh & Koelz 265* (MICH, type).

ZACATECAS: Sierra de los Morones, near Plateado, 1 Sep 1897, *Rose 2720* (K). Otherwise unknown.

The group of coarse annuals that includes *Xanthocephalum gymnospermoides,* and *X. benthamianum* Hemsl., may eventually be treated as a single species. There are scarcely any quantitative differences between them, but superficially they look very different because the leaves in *X. benthamianum* are more coarsely toothed and because the herbage (including the phyllaries) in that species is abundantly provided with gland-tipped hairs, whereas in *X. gymnospermoides* the gland-tipped hairs are restricted to the small branchlets and the peduncles. In this new variety, which as far as known has a distinctive geographical range, gland-tipped hairs are essentially wanting; the whole plant is uniformly gummy but otherwise glabrous.

Tribe II. Cichorieae

New Varieties of *Lactuca graminifolia*

In tropical America the genus *Lactuca* is represented by a very small number of species, and these species are seldom taken by collectors. It is therefore of unusual interest to find, among the collections recently made in Chiapas by D. E. Breedlove and Peter H. Raven, an ample series of specimens of a perennial "pink" or purplish-flowered *Lactuca.* The affinities of this plant appear to be with the group of temperature North American species having strongly flattened achenes with an elliptic body and a very slender and delicate herbaceous beak about a third to a half as long as the body. This is the group that includes *Lactuca graminifolia* Michx., *L. hirsuta* Muhl., and *L. ludoviciana* (Nutt.) Ridd. The species, if they are correctly so regarded, are not easily separated, and an experimental investigation of the entire complex would be worthwhile. The differences between the supposed species have been expressed mostly in terms of vegetative structures (see, for example, Gray's Man. ed. 8. p. 1554. 1950).

The Chiapas plant, described below as a variety of *Lactuca graminifolia,* occurs in moist forested areas at moderate elevations (mostly between 1500 and 2500 meters), where it is associated with species of *Quercus, Pinus, Liquidambar, Podocarpus* and other trees. From this same habitat many species and genera of "temperate" affinities have been reported in recent years by A. J. Sharp and others, so it is not surprising to find that this plant seems to represent a distinct and well-established population of a species already known in southeastern United States. The following key contrasts the Chiapas plant with what appear to be its closest relatives:

1. Soft beak 2–2.5 mm long or more, usually a third to a half as long as the body of the achene; cauline leaves numerous, rather uniformly distributed along the stem, the rosette leaves often not present at flowering time; flowers yellow (or sometimes blue).
   2. Lower bracts of the inflorescence leafy, considerably larger than the upper ones; cauline leaves, even the upper ones, with acuminate auricles at base; soft beak usually 2.5 mm long or more; flower color usually recorded as "pale blue" or lavender, sometimes as yellow; central United States. *L. ludoviciana.*
   2. Lower bracts of the inflorescence not enlarged and leafy; cauline leaves narrowed to the base, not auriculate; soft beak 2–2.5 mm long, almost half as long as the body; flower color usually recorded as yellow or "coppery"; mostly northeastern United States. *L. hirsuta.*
1. Soft beak 1–2.5 mm long, usually one-third as long as the body of the achene, or less; cauline leaves usually much reduced at least in the upper part of the stem, the rosette leaves often conspicuous at flowering time; flower color recorded as "purple," "purplish blue," "pale blue," lavender, "pink," or white.
   3. Cauline leaves usually narrow and entire or with narrow lobes, evidently different from the radical leaves, the plants often subscapose.
      4. Multicellular foliar trichomes usually none; inflorescence usually ample, diffusely branched; soft beak 1.5–2.5 mm long; Coastal Plain of southeastern United States. *L. graminifolia* var. *graminifolia.*
      4. Multicellular foliar trichomes probably always present (especially on the leaf-margins and on the midvein of the lower surface); inflorescence sparingly branched, the primary branches often simple; soft beak 1.5–2 mm long; mountains of Arizona, New Mexico and extreme western Texas. *L. graminifolia* var. *arizonica.*
   3. Cauline leaves usually like the radical ones, relatively little reduced in size up to the middle of the stem or above, the uppermost sometimes narrow and entire; multicellular trichomes probably always present; inflorescence usually ample, diffusely branched; soft beak 1–1.7 (–2) mm long; Sierra Madre Oriental of Mexico, to Guatemala. *L. graminifolia* var. *mexicana.*

The following plant of the mountains of southwestern United States has customarily been referred to *Lactuca graminifolia.* It differs consistently in several respects from the nomenclaturally typical variety, and may be named and described as follows:

Lactuca graminifolia Michx., var. **arizonica** McVaugh, var. nov. Var. *graminifoliae* similis; folia basalia trichomatibus semper instructa; folia caulinia basi exauriculata; rostri pars gracilis 1.5–2 mm longa, quam achaenium ca triplo brevior; flores caerulei; paniculae rami primarii 2–6 (–10) cm longi, saepe simplices.

Pine forests, and in canyons and other relatively mesic habitats in semiarid mountains, at elevations of 1000–2400 m, flowering from May to July or as late as September.

ARIZONA: COCHISE CO.: Dos Cabezas Mts., Magnesia Spring, May 1881, *J. G. Lemmon 228* (GH); Huachuca Mts., Miller's Canyon, 15 Jun 1909, *L. N. Goodding 139* (GH); Chiricahua Mts., Cave Creek, 22 Sep 1929, *Harrison & Kearney 6192* (GH). APACHE CO.: Willow Spring, 10–20 Jun 1890, *E. Palmer 510* (GH). PIMA–STA. CRUZ CO.: Santa Rita Mts., 27 May 1881, *C. G. Pringle* (GH). COCONINO CO.: Flagstaff, 12 Aug 1884, *M. E. Jones 16* (GH); Oak Creek Canyon, 18 Jun 1944, *O. M. Clark 11860* (GH). GILA CO.: Sierra Ancha Mts., 5 Jun 1946, *F. W. Gould 3581* (GH, NY).

NEW MEXICO: Without locality, *Fendler 504* in 1847 (GH). GRANT CO.: Foot of Twin Sisters, near Silver City, 22 Jun 1880, *E. L. Greene 143* (GH, type).

TEXAS: CULBERSON CO.: Guadalupe Mts., above Frijole P.O., elevation "8000 ft.," 10 Aug 1930, *C. O. Grassl 133.*

What seems to be nearly typical *L. graminifolia* var. *graminifolia* also occurs in northern Mexico. In these specimens the cauline leaves are numerous, well scattered along the stem, very long and narrow, the lower ones narrowly pinnatifid and bearing scattered trichomes, the upper ones linear; the panicle is ample, with subulate bracts subtending even the lower branches; the beaks are 2 mm long or a little more, which is about average for var. *graminifolia:*

MEXICO: NUEVO LEON: "Sierra Madre Mts.," Monterrey, 23 Jul 1933, *C. H. & M. T. Mueller 285* (GH); Dulces Nombres, 24° N., ca 100° W, elev. 1500 m, 15 Jul 1948, *Meyer & Rogers 2787* (US).

In the mountains of central and western Texas and northern Mexico, also, there are populations that seem to be intermediate in some ways between *Lactuca ludoviciana* (a species primarily of the Great Plains), and another species, possibly *L. graminifolia.* These plants have numerous cauline leaves that are thinner, and somewhat more deeply and narrowly pinnatifid, than those of *L. ludoviciana,* and lack the closely spinose-denticulate margins of the leaves of that species. The larger outer phyllaries are not very broad (compared to those in e.g. *L. graminifolia*), but the beaks are mostly more than 2 mm long, and the lower bracts of the panicle are leafy. Examples of these plants are:

TEXAS: "Near Dallas," *J. Reverchon,* Jun 1874 (GH); BURNET CO.: 1 mi west of Marble Falls, 6-4-1945, *V. L. Cory 49569* (GH); KERR CO.: Laceys Ranch, 10 Jun 1917, *E. J. Palmer 12220* (GH); PRESIDIO CO.: Knox Canyon, elev. 1525 m, 20 Jul 1941, *L. C. Hinckley 2038* (GH); BREWSTER CO.: Oak Canyon, Chisos Mts., elev. 1370 m, 4 Jul 1931, *Moore & Steyermark 3393* (GH, MICH).

MEXICO: COAHUILA: Sierra Hechiceros, near the Chihuahuan boundary, 27–29 Sep 1940, *R. M. Stewart 123* (GH); Sierra de los Guajes, 10 Sep 1941, *Stewart 1521* (GH).

NUEVO LEON: Hacienda Vista Hermosa, 35 mi south of Monterrey, elev. 750 m, 26 Jun 1939, *S. S. White 1533.*

TAMAULIPAS: Vicinity of Victoria, elev. 320 m, May–Jun 1907, *E. Palmer 447* (GH, NY).

One specimen from northern Mexico is superficially much like those cited above, but the lower bracts of the panicle are not leafy, and the beaks are no more than 1.5 mm long. In 1931 S. F. Blake identified this plant as "Intermediate between *L. canadensis* L. and *L. ludoviciana* (Nutt.) Riddell." As apparently *L. canadensis* has not been reported from this part of Mexico, and as representatives of *L. graminifolia* are known to occur nearby, it seems more probable that if the following is an "intermediate," that is to say of hybrid origin, the most likely parents are *L. ludoviciana* and *L. graminifolia.*

MEXICO: TAMAULIPAS: Sierra de San Carlos, vicinity of San José, Cerro Barril, elev. 1380 m, 19 Jul 1930, *H. H. Bartlett 10493.*

In the following variety the tendency to produce cauline leaves (which are often auriculate) suggests some remote evolutionary connection with a species like *L. ludoviciana,* but in other respects the plants are not very different from those of the other varieties of *L. graminifolia:*

Lactuca graminifolia Michx., var. **mexicana** McVaugh, var. nov.

Perennis, subscaposa, glabra (phyllariorum apicibus minute puberulis), 1–1.5 m alta, foliis radicalibus 15–30 cm longis, 5–8 cm latis, plusminusve runcinato-pinnatifidis, marginibus et costa (subtus) sparsim trichomatibus multicellularibus instructa; folia caulinia vel lobata vel integra, basi plerumque auriculata, auriculis acuminatis; capitula 14–17 mm longa, angusta, phyllariis interioribus 8, subaequalibus, angustis, 11–16 mm longis, phyllariis exterioribus gradatis 8–10, multo brevioribus; achaenia 4.5–6 mm longa (rostello conico incluso), in rostrum fragile tubuliforme 1–1.7 longum prolongata. A var. *graminifolia* rostro breviore, foliis caulinibus majoribus auriculatis, trichomatibusque foliaribus; et a var. *arizonica* rostro paullo breviore, foliis caulinibus paniculisque diffusis, differt.

Perennial; foliar trichomes flexuous, up to 2–3 mm long; leaves often in a basal rosette, the rosette leaves and the lower cauline leaves deeply pinnatifid, the 2–4 pairs of lobes at right angles to the long axis or usually directed backward, usually acute and sometimes themselves again lobed, the sinuses between the lobes broad, rounded; margins with a few spinulose teeth; leaf-rachis between the lobes 4–10 (–15) mm wide; petiolar base 2–5 (–10) cm long, about as wide as the rachis, proximally slightly widened (except in the lowermost leaves) and prolonged into acuminate auricles; cauline leaves decreasing in size upward, and with smaller lobes; leaves above the middle of the stem, if any, often narrowly lanceolate and entire, usually auriculate; inflorescence a diffusely branched, subcorymbose panicle of many ascending principal branches, these 10–20 cm long, from the upper third or half of the plant; bracts at the base of the branches subulate, 3–10 (–15) mm long; heads numerous, erect, 14–17 mm long in fruit, solitary at the tips of the principal branches or lateral secondary peduncle-like branchlets 1–5 cm long, each peduncle usually bearing several small bracts and sometimes abortive heads in the axils of the bracts; inner phyllaries pale green with narrow hyaline margins, nearly linear, 1.5–2 mm wide, gradually tapering to an obtusely pointed tip, thin and fragile except at the slightly indurated bases, strongly reflexed and persistent after anthesis, exposing the (finally) convex, lustrous, slightly pitted receptacle 2–3 mm wide; outer phyllaries 8–10, imbricated and very unequal, lance-ovate or the outermost broader, the longest one half as long as the inner series or a little longer; flowers 18–21, lavender or purplish, "pink" or white, at anthesis about 5 mm longer than the phyllaries; anthers about 2 mm long; achenes nearly black (dark brown), without conspicuous nerves, or the midline convex on both sides; body elliptic, strongly flattened, terminated by an acute rostellum like the body in color and texture, this passing into a slender pale or green, softly herbaceous beak much shorter than the body; surface of the achene minutely and sinuately cross-striate, the striae (especially along the midline) antrorsely echinulate; body of achene 1.5–2.3 mm wide, 4.5–6 mm long including the rostellum, the soft part of the beak 1–1.7 (–2) mm long, enlarged distally into a disk about 0.5 mm in diameter, from the margin of which arises the pappus; pappus bright white, 8–9 mm long, of very numerous, very delicate, antrorsely barbellate bristles; chromosome number $n = 17$ (*Raven & Breedlove 19906, King 3346*).

MEXICO: TAMAULIPAS: Sierra de San Carlos, La Vegonia, vicinity of San José, elev. 960 m, 5 Jul 1930, *Bartlett 10072* (GH, MICH).

VERACRUZ: Between Misantla and Naolinco, Aug 1912, *Purpus 6037* (GH); near Jalapa, 13 May 1900, *Pringle 9194* (GH); Orizaba, *Botteri 107* (GH), *Botteri & C. Mohr* in 1857 (US), *Botteri 366* in Oct 1854 (P).

OAXACA: Trapiche de la Concepción, *Liebmann,* Compos. Mex. 290 (GH, tracing ex herb. Klatt., probably this variety).

CHIAPAS: Mpio. Jitolol, elev. 2000 m, 28 Aug 1966, *Breedlove 15422;* Mpio. Pueblo Nuevo Solistahuacán, elev. 1620 m, 23–24 Jan 1965, *Raven & Breedlove 19906*; Mpio. Rayón, elev. 1830 m, 20 Aug 1965, *Breedlove 11990*; Mpio. San Cristóbal de las Casas, elev. 2130 m, 24 Aug 1964, *Breedlove 7093*; Mpio. Tenejapa, elev. 1200 m, 14 Jul 1964, *Breedlove 6431;* 25 Nov 1964, *Breedlove 7582* (DS), elev. 2250 m, 30 Sep 1965, *Breedlove 12557*, elev. 2700 m, 23 Aug 1966, *Breedlove 15259*; Mpio. de Teopisca, elev. 1770 m, 19 Aug 1966, *Breedlove 15041* (MICH, type); Mpio. de La Trinitaria, elev. 1560 m, 25 Nov 1964, *Breedlove 14989* (DS).

GUATEMALA: ALTA VERAPAZ: 9 mi W of San Cristóbal Verapaz, 13 Jul 1960, *R. M. King 3346* (MICH, NY); Cobán, elev. 1350 m, Mar 1908, *H. von Tuerckheim II 1285* (GH, US).

The Genus *Pinaropappus*

In 1951 L. H. Shinners published a new variety of *Pinaropappus roseus,* and at the same time listed the six accepted species of the genus to which the species belongs (Field & Lab. 19: 48). Two species, *P. parvus* Blake, and *P. multicaulis* Brandg., are restricted in range and morphologically distinctive (see map, Fig. 3). The others listed by Shinners, and the species newly described below, appear to be in need of further study. Apparently there are two principal species-groups, the one typified by *P. roseus*

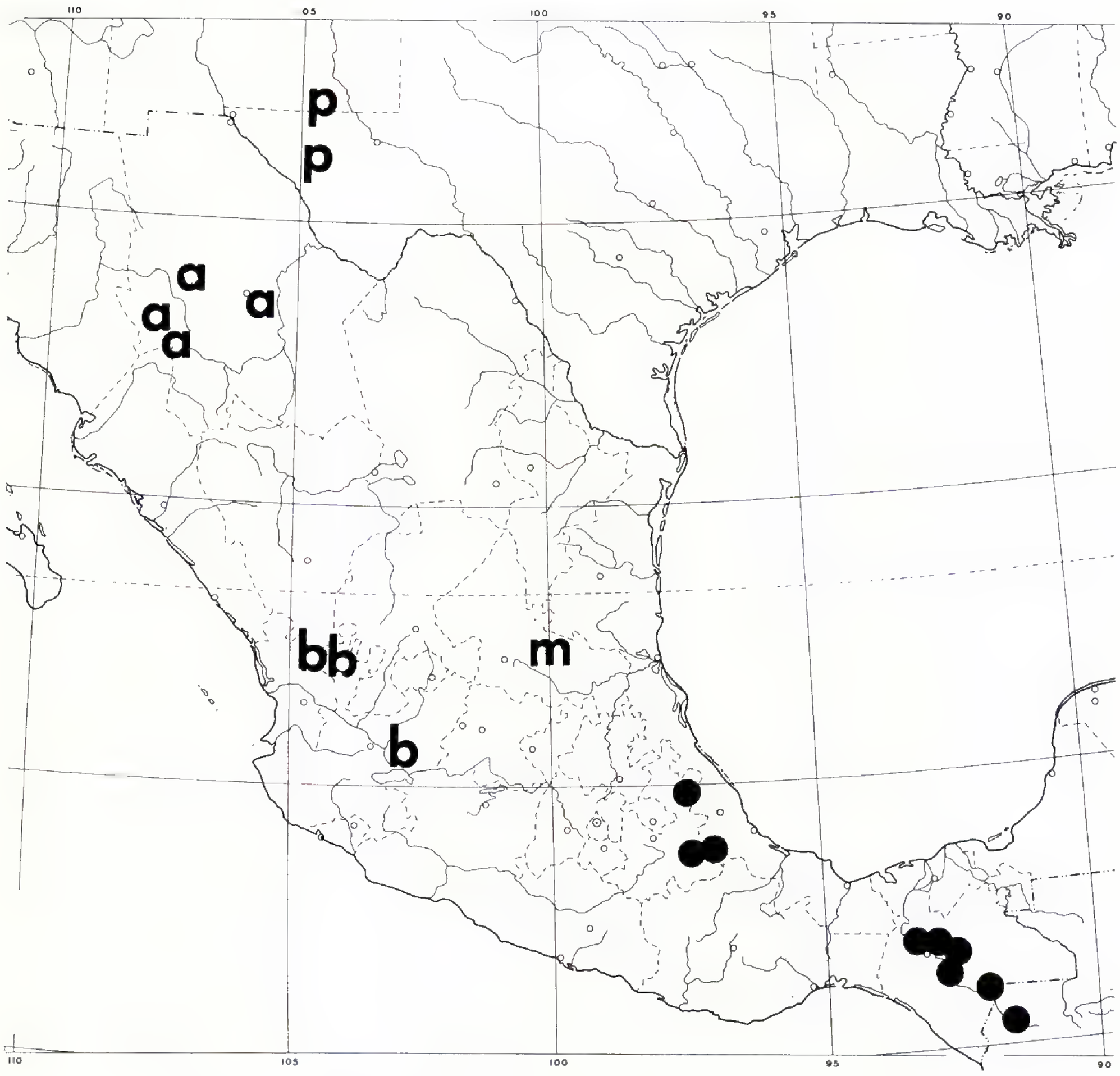

FIG. 3. Distribution of *Pinaropappus.* Solid circles represent *P. spathulatus.* a, *P. junceus.* b, *P. diguetii.* m, *P. multicaulis.* p, *P. parvus.*

(Less.) Less., and the other by *P. spathulatus* Brandg. The group of *P. roseus* is widespread from Texas and Arizona to Oaxaca (Fig. 5); on the basis of herbarium material it is obviously to be divided into several regional varieties. Probably members of the same complex, but here recognized as independent species, are *P. junceus* A. Gray (Chihuahua) and *P. diguetii* McVaugh (Jalisco and Nayarit). The group of *P. spathulatus* ranges from Puebla and Veracruz to Guatemala, and seems to comprise two regional varieties. The relationships between populations in this genus, and the inter- and intra-specific variation, merit experimental study beyond the scope of this paper. I have attempted merely to provide a synopsis in which three newly described taxa may be assigned places with their supposed relatives.

Key to the Principal Taxa

1. Phyllaries without broad scarious or black tips, sometimes purplish at the acute tip and with purplish midline; involucre less than 1 cm long; caespitose rock-plants of western Texas and adjacent New Mexico. *P. parvus.*
1. Phyllaries with broad, often deltoid or sagittate, scarious or blackish areas near the tips.
   2. Leaves obovate-spatulate, entire, apparently coriaceous or fleshy, all in a basal rosette, 4–8 cm long, 1–2 cm wide; involucre 10–12 mm long, the middle phyllaries very broad and obtuse, ciliate-fringed, up to 3.5 mm wide and 6 mm long; saline areas, San Luis Potosí. *P. multicaulis.*
   2. Leaves basal and cauline or, if all basal and entire, membranous and usually smaller; involucre about 1.5 cm long, or, if smaller, the middle phyllaries 1.5–2 mm wide, narrowed to an acute or obtuse tip.
      3. Involucre about 15 (12–20) mm long; middle phyllaries oblong or tapering to the tips; tips of the middle and outer phyllaries mostly pale brown, variously ciliate-fringed or merely pubescent but not ciliate.
         4. Middle phyllaries prevailingly oblong, 7–9 mm long, 2–3 mm wide; outermost phyllaries ovate or obovate, mostly 1.5–2 times as long as wide, 1.5–2.5 mm wide; phyllaries (except sometimes the narrow innermost ones) coarsely pubescent near tips but not finely ciliate; radical leaves usually present and pinnatifid-toothed; central and southern Mexico, widespread. *P. roseus* var. *roseus.*
      4. Middle phyllaries prevailingly tapering to the tip from the base or from the middle; outermost phyllaries broad or narrow; tips of phyllaries sometimes finely ciliate; leaves various.
         5. Middle phyllaries linear or narrowly tapering, 1.5–1.7 mm wide, 6–7.5 mm long, usually purple-blotched; tips not or scarcely ciliate; outermost phyllaries 0.9–1.2 mm wide, 2.5–3.3 times as long as wide; leaves narrowly linear, entire or the rosette-leaves toothed; arid areas, Zacatecas, San Luis Potosí and Nuevo León. *P. roseus* var. *maculatus.*
         5. Middle phyllaries elliptic to rhomboid-obovate, if tapering from the base then mostly 2 mm wide or more; outermost phyllaries 1.5–3 mm wide, 1.5–2 times as long as wide (sometimes as wide as long); leaves various.
            6. Middle phyllaries prevailingly elliptic, 1.8–2.8 mm wide and 3 (–4) times as long as wide; tips of the phyllaries not ciliate; outermost phyllaries 1.4–2 mm wide and usually about twice as long as wide; rosette-leaves usually pinnatifid, conspicuous at flowering time; cauline leaves often few or none; Texas, Nuevo León and Coahuila. *P. roseus* var.
            6. Middle phyllaries prevailingly rhomboid-obovate, sometimes broadly elliptic, (2.5–) 3–4 mm wide; outermost phyllaries 2.3–3 mm wide, often almost as wide as long; cauline leaves usually several, broadly linear and entire; rosette-leaves inconspicuous or absent at flowering time; western Mexico.
               7. Tips of the middle and inner phyllaries finely ciliate-fringed; flowers white; middle phyllaries erose, obtuse, about twice as long as wide; northern Jalisco and adjacent Nayarit. *P. diguetii.*
               7. Tips of the phyllaries not ciliate-fringed; flowers pink; middle phyllaries very shortly cuspidate, 2.3–3 times as long as wide; northwestern Chihuahua, northeastern Sonora, and adjacent Arizona. *P. roseus* var. *foliosus.*
      3. Involucre 9–13 mm long; middle phyllaries prevailingly tapering to the tips from the middle or sometimes from the base; tips of the middle and inner phyllaries usually finely ciliate-fringed, the discolored apical portions often black or nearly so; outermost phyllaries 0.6–1.2 mm wide, and usually 3–4 times as long.

8. Leaves narrowly linear or filiform, prevailingly cauline; western Chihuahua. *P. junceus.*
8. Leaves linear to spatulate, mostly basal, or basal and cauline; Veracruz to Central America.
   9. Middle phyllaries 1–1.5 mm wide, long-tapering or linear, 3–5 times as long as wide; acute inner phyllaries usually evidently prolonged beyond the middle and outer ones; Veracruz and Puebla. *P. spathulatus* var. *spathulatus.*
   9. Middle phyllaries 1.5–2.5 mm wide, prevailingly elliptic, 2.5–3.5 times as long as wide; inner phyllaries, except sometimes those resembling large paleae, not evidently prolonged; Chiapas and Guatemala. *P. spathulatus* var. *chiapensis.*

Pinaropappus diguetii McVaugh, sp. nov.

Herba perennis, caespitosa, glabra, subscaposa, caulibus striatis, pauciramosis, 30–60 cm altis; folia basalia ignota, caulinia linearia, integra, anguste acuta, 5–10 cm longa, 2–3.5 mm lata; folia superiora multo minora, bracteiformia, 2–10 mm longa; capitula solitaria, erecta, longe pedunculata; involucrum campanulatum, 1.5–2.2 cm longum; phyllaria 40–50, versus basin viridia, apicibus plumbeis sagittatis conspicuis; phyllaria media late elliptica vel rhomboidea, prope medium 3–4 mm lata, versus apicem obtusum vel subobtusum angustata; phyllariorum apices ciliato-fimbriati (pilis usque ad 0.5 mm longis), mox erosi et lacerati; bracteae sub involucrum 6–12, imbricatae, late ovatae vel irregulariter rotundae, 2–3 mm longae lataeque, basi carnosae, convexae, phyllariis exterioribus similes; flores circiter 70, albi, 2.2–2.5 cm longi, ligulis basi pilosis; antherae 5 mm longae; paleae scariosae, lanceolatae, longe attenuatae, ca 15 mm longae; achaenia matura ignota; pappus setis 11 mm longis capillaribus barbellatis, sordidis.

A deep-rooted perennial with multicipital caudex, the cauline leaves mostly in the lower third of the stem; the plant is easily recognized by the relatively large heads of white flowers, the broad elliptic phyllaries with ciliate lead-colored tips that are soon much frayed and broken, and the numerous broad imbricated accessory bracts with green and somewhat fleshy bases.

JALISCO: Near km 58, road from Zapotlanejo, ca 11 km west-northwest of Tototlán, elev. 1800 m, 24 Aug 1958, *McVaugh 17262* (MICH, type); Sierra de Nayarit, partie occidentale, *L. Diguet s.n.* (P, MICH). NAYARIT: Between Santa Gertrudis and Santa Teresa, 8 Aug 1897, *J. N. Rose 2094* (US).

Species in memoriam cel. Léon Diguet (1859–1926), cui debetur "Les Cactacées utiles du Mexique," nominavi.

Evidently akin to *P. roseus,* but differing from it by characters like those that distinguish *P. spathulatus* in eastern Mexico, *P. diguetii* is restricted as far as known to the high grasslands and adjacent mountains in northern Jalisco and Nayarit. It resembles *P. roseus* var. *foliosus* in habit and vegetative characters, and in the relatively large heads with broad elliptic to rhombic-obovate or even suborbicular phyllaries. *P. diguetii* shows to the greatest extent of any *Pinaropappus* the combination of stout stem with numerous cauline leaves; large and many-flowered heads; broad phyllaries that are widest at or near the middle, and green or whitish (not purple) below the discolored tips; outer phyllaries numerous and closely imbricated, pale and fleshy or convex at base, and broadly erose or lacerate at the broad tips. The flowers are white, the tips of the principal phyllaries are ciliate-fimbriate, and the discolored areas near the middle of the phyllaries tend to be lead color rather than brown. In *P. roseus* the flowers are never white as far as I know, the tips of the phyllaries are closely and coarsely short strigose but not at all or only very sparingly ciliate, the discolored tips of the phyllaries are usually pale or dark brown (sometimes with a narrow transverse black zone), and the phyllaries are usually purple or purplish below the discolored tips and not at all or scarcely thickened at base (except sometimes in var. *foliosus*).

Although the differences between *P. roseus* and *P. diguetii* are readily seen and demonstrated, the separation of the two taxa remains a somewhat subjective matter. Experimental investigation of the relationships between *P. roseus* var. *foliosus, P. diguetii,* and *P. roseus* var. *roseus,* might be most rewarding.

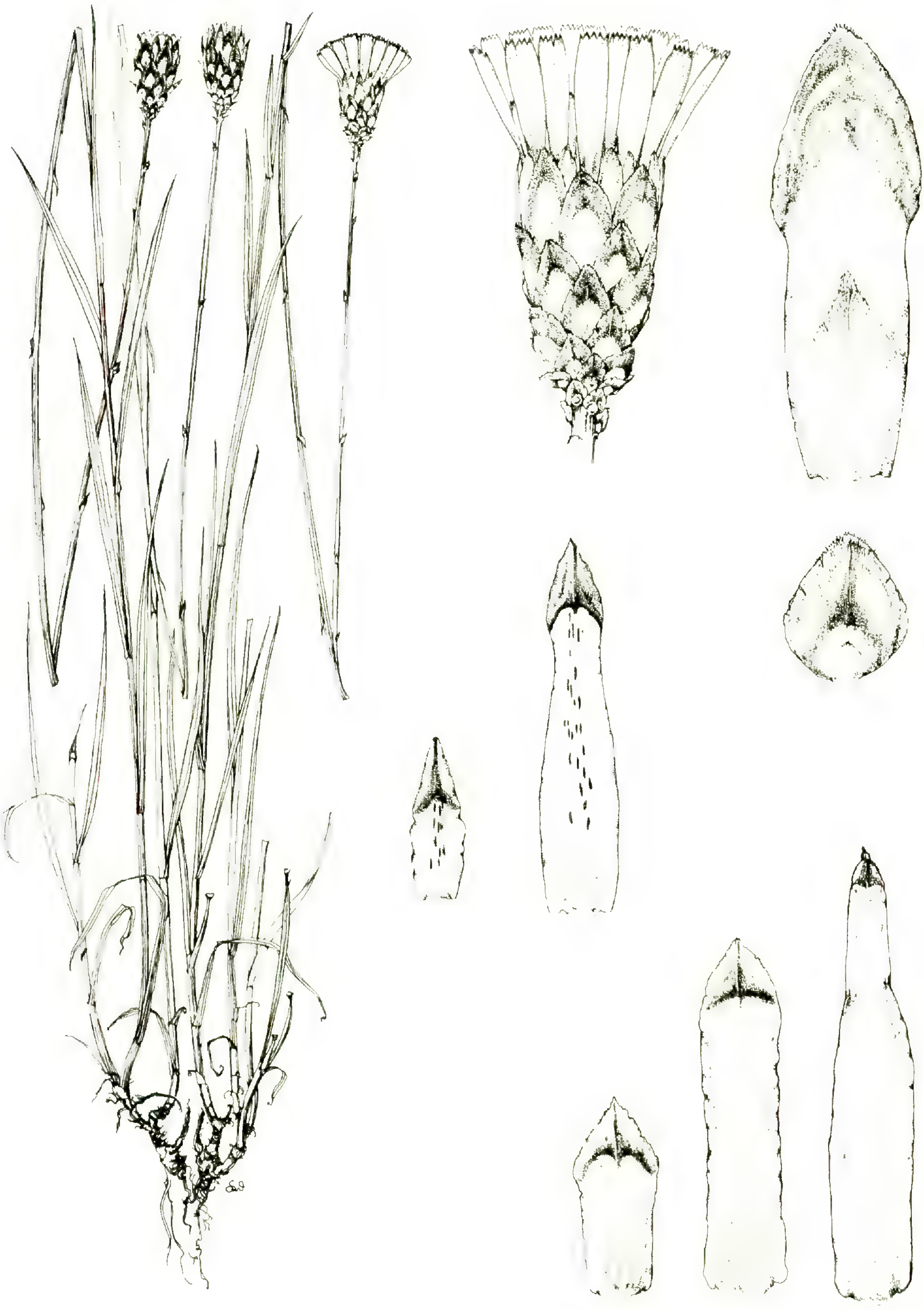

FIG. 4. *Pinaropappus diguetii* and *P. roseus.* Flowering plant, X ½ (*McVaugh 17262,* type of *P. diguetii*). Flowering head of *P. diguetii* (type), X ½. Middle and outer phyllaries of *P. diguetii* (type, upper right), *P. roseus* var. *maculatus* (*Shreve 9395,* type, at center), and *P. roseus* var. *roseus* (Jalisco, *McVaugh 16847,* lower right), all X 5.

Pinaropappus junceus A. Gray, Proc. Am. Acad. 22: 307. 1887.

Originally based on a collection by Pringle from the Mapula Mountains of Chihuahua, this name has been rather loosely applied to almost any very narrow-leaved *Pinaropappus* from western Mexico. In the protologue Gray emphasized the "subulate-setaceous" cauline leaves, and the small heads (said to be half as large as those of *P. roseus,* and with fewer flowers). I have not seen the type. The following, with small heads, very narrow and almost setaceous leaves, and narrow tapering phyllaries with ciliate tips, presumably represent *P. junceus,* which I take to be a very local species confined to western Chihuahua:

CHIHUAHUA: Mojárachic, elev. 2140 m, 10 Aug 1954, *Knobloch 1169*; Areponápuchic, Barranca de Urique, elev. 1000–1800 m, 23 Aug 1954, *Knobloch 1374.*

Pinaropappus roseus (Less.) Less. Syn. Gen. Comp. 143. 1832. *Achyrophorus roseus* Less. Linnaea 5: 133. 1830.

Originally described from Veracruz, *P. roseus* var. *roseus* is widespread and relatively uniform in the mountains of southern Mexico (see map, fig. 5). I have not seen the type; Lessing's original description of *Pinaropappus* (Syn. Gen. Comp. 143. 1832) emphasized the pinnatifid-dentate radical leaves and the characteristic tips of the phyllaries ("margine apicali latissime scariosis"), both of which presumably apply to what all later authors have called *P. roseus.*

The var. *roseus,* as I understand it, is at once recognized by the linear-oblong middle phyllaries which are usually not at all fringed at the tips, and by the pinnatifid-dentate basal leaves usually present at flowering time; the plants may be scapose or subscapose, but some narrow and usually entire cauline leaves are almost always present.

In Texas and northeastern Mexico almost all the specimens have somewhat elliptic or tapering phyllaries, but in vegetative characters and in other characters of the inflorescence, they are closely similar to specimens of var. *roseus.* These northeastern representatives of the species comprise a recognizably distinct population. I have not attempted to describe or name this Texano-Mexican variety because of the want of sufficient material for study. A few Texas specimens (e.g. *H. R. Reed s.n.,* from Roosevelt, Kimble Co.) are indistinguishable from Mexican material of var. *roseus.*

Another even more local regional population exists in the arid highlands from Zacatecas to Nuevo León. The plants are prevailingly small and scapose, 15 cm high or less, with narrow or linear and often pinnatifid-dentate basal leaves; the narrow phyllaries, which are usually irregularly blotched with small purple spots below the narrow blackish tips, are distinctive. This taxon may be characterized as follows:

Pinaropappus roseus (Less.) Less., var. **maculatus** McVaugh, var. nov.

Perennis, caespitosa, subscaposa, scapis unifloris 5–15 cm longis; a var. *roseo* phyllariis angustioribus, 1.5–1.7 mm latis, 6–7.5 mm longis, purpureo-maculatis, foliis perangustis differt.

ZACATECAS: Rocky slopes, base of Pico de Teyra, elev. ca 2000 m, 12 Sep 1939, *F. Shreve 9395* (MICH, type); slopes of Cerro Picacho about 8 km east of Chalchihuites, elev. 2500–3000 m, 14 Jul 1950, *Maysilles 7388;* 4 mi north of Zacatecas, eroded mountainsides, elev. ca. 2430 m, 24 Sep 1959, *Soderstrom 718.* SAN LUIS POTOSI: Charcas, 30 Jun 1934, *Lundell 5063.* NUEVO LEON: Mpio. de Galeana, San José de Raices, 1 Aug 1935, *Mueller 2324.*

In Arizona and adjacent Chihuahua and Sonora *Pinaropappus* is represented by *P. roseus* var. *foliosus* Shinners (Field & Lab. 19: 48. 1951), originally distinguished from var. *roseus* because the leaves are mostly cauline rather than basal, and are notably long and narrow. Rather a small number of specimens is available for study, but it seems that var. *foliosus* comprises a homogeneous population, differing in a number of ways from var. *roseus,* and in fact intermediate between var. *roseus* and the newly described *P. diguetii.* Var. *foliosus* has slightly larger heads than var. *roseus,* with

broader phyllaries that tend to be elliptic to obovate rather than oblong. The principal phyllaries are cuspidate, a feature that is otherwise rare in this group of *Pinaropappus,* although seen in an occasional specimen throughout the range of var. *roseus.* The outer phyllaries and the bracts subtending the involucre are broader, more numerous and more conspicuous than those of var. *roseus,* with pale and often fleshy bases and often very broad and thin frayed margins.

The following are representative of var. *foliosus:*

ARIZONA: Huachuca Mountains, elev. ca 1800–2400 m, 5 Jul 1884, *Pringle s.n.* CHIHUAHUA: Sierra Charuco, Rancho Byerly, elev. ca 1500–1750 m, 17–25 Apr 1948, *Gentry 8093*; Colonia Garcia, elev. ca 2200 m, 4 Jun 1899, *Townsend & Barber 10* (US), 1–20 Aug 1899, *Nelson 6193* (US); Madera, elev. 2250 m, May–Jun 1908, *E. Palmer 316* (US); Canyon de Río San Miguel, 2 Jul 1891, *C. V. Hartman 720* (US). SONORA: Region of the Río de Bavispe, Jun–Aug 1940, *S. S. White 2844, 3191, 3445.*

Plants with the leaves mostly linear and cauline, i.e. in this respect like *P. diguetii* and *P. roseus* var. *foliosus*, but otherwise referable to *P. roseus* var. *roseus,* are not uncommon in the western part of the range of var. *roseus.* One specimen from northeastern Jalisco, near the type-locality of *P. diguetii,* exactly simulates plants of

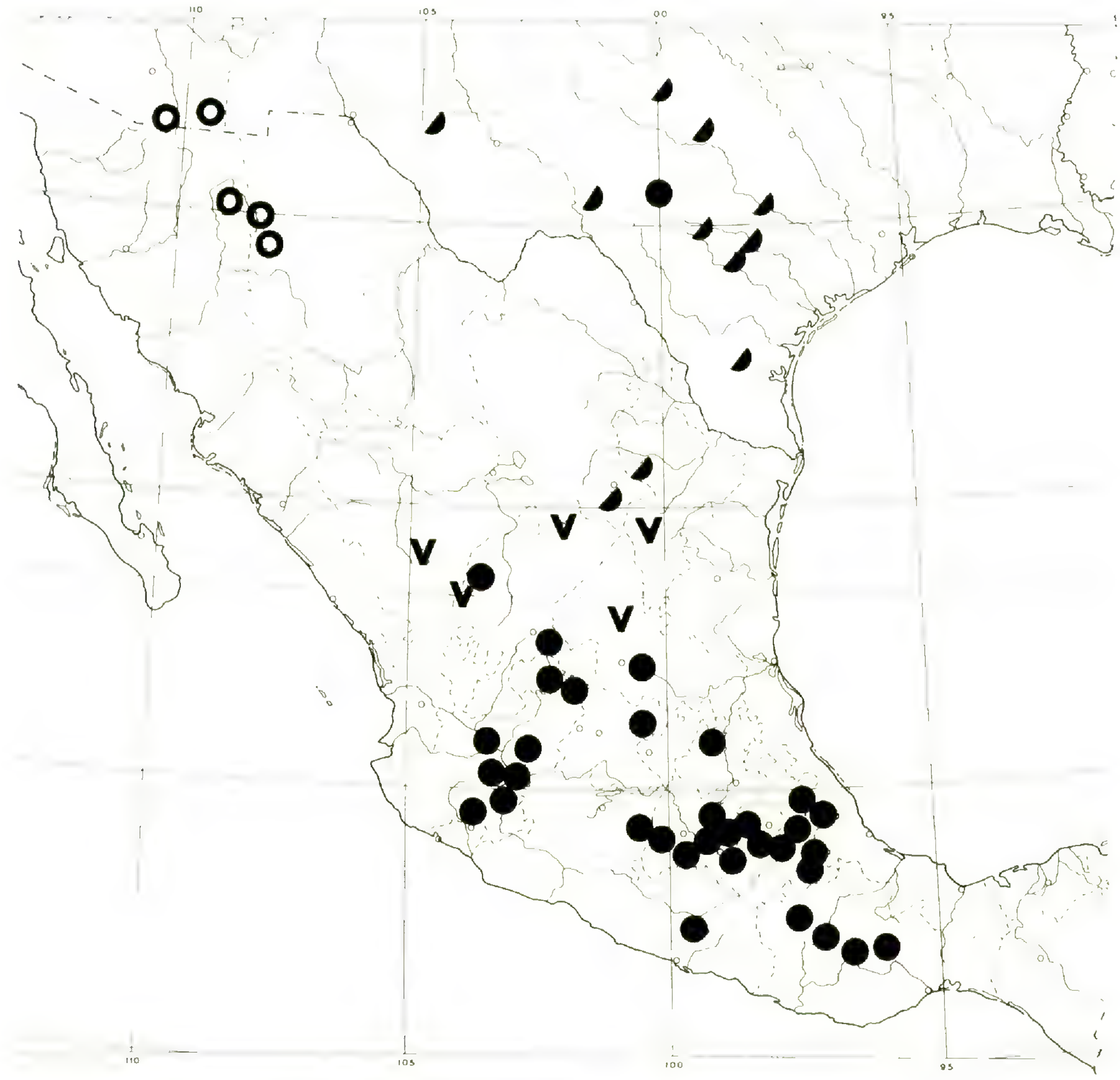

FIG. 5. Distribution of *Pinaropappus roseus.* Solid circles, *P. roseus* var. *roseus.* Half-circles, an unnamed variety. Open circles, var. *foliosus.* Boldface **V**, var. *maculatus.*

var. *foliosus* except that the phyllaries are not cuspidate (Cerro Gordo, southeast of Tepatitlán, *McVaugh 17512,* at MICH). It is tempting to speculate that plants with well-developed cauline leaves and few or no basal leaves may be primitive in this respect in this genus, and that the existing taxa in the mountains of western Mexico may have evolved from an ancestor with such leaves.

Pinaropappus spathulatus Brandg. Zoe 5: 241. 1906. *Pinaropappus caespitosus* Brandg. Univ. Calif. Publ. Bot. 4: 388. 1913.

These are plants with long narrow or spatulate and usually entire basal leaves, few cauline leaves and these usually very near the base, heads considerably smaller on the average than those of *P. roseus,* both inner and outer phyllaries narrow, and more tapering than those of *P. roseus,* with darker and usually ciliate-fringed tips. The group is regionally restricted, as far as known, to the Atlantic slope of Veracruz and Puebla, and to the highlands of Chiapas and Guatemala. In a genus like *Pinaropappus,* in which differences between species are nowhere very great, *P. spathulatus* is one of the more easily recognizable species. The type of *P. spathulatus* represents a local population with consistently narrow phyllaries. The type of *P. caespitosus* Brandg. (a name referred by Shinners to the synonymy of *P. spathulatus*) has somewhat broader phyllaries. I should agree with Shinners that *P. spathulatus* and *P. caespitosus* are synonymous; the type of the latter, however, came from Boca del Monte, near the border between Veracruz and Puebla, from an area where *P. roseus* in typical form is well known. If gene-exchange between *P. roseus* and *P. spathulatus* is possible, it seems not unlikely that *"P. caespitosus"* reflects this. The typical variety of *P. spathulatus* has apparently been little collected. I have seen only the following:

VERACRUZ: Orizaba, May 1905, *C. A. Purpus 1165* (UC, type), *C. Mohr s.n.* (US); Cofre de Perote, Sep 1866, *L. Hahn s.n.* (P). PUEBLA: Boca del Monte, Apr 1912, *Purpus 5816* (UC, type of *P. caespitosus*), Jun 1913, *Purpus 6407* (UC, US); "Puebla near Oaxaca," Sep 1909, *Purpus 4223* (UC).

The following variety has been collected in several localities in Chiapas and Guatemala in recent years. It is chiefly a plant of rocky or grassy slopes in forested mountains, often in full sun, with *Quercus, Pinus, Liquidambar* and other trees, at elevations from 1000 to 2500 meters. In aspect and in all vegetative and reproductive features it suggests *P. spathulatus* rather than *P. roseus.* In fact these Central American populations seem to differ from those of var. *spathulatus* chiefly in having somewhat larger, relatively broader and differently shaped phyllaries, and in the feature noted in the key, that in var. *spathulatus* the narrow inner phyllaries tend to be prolonged noticeably beyond the blunt outer phyllaries that form the base of the involucre.

Pinaropappus spathulatus Brandg., var. **chiapensis** McVaugh, var. nov.

Herba caespitosa, glabra, subscaposa, caulibus subsimplicibus 20–30 cm altis; folia integra vel sublobata, linearia, 5–12 cm longa, 1–3 mm lata, vel oblanceolata vel spathulata, vel latiora elliptica, 1 cm lata, petiolata; capitula solitaria, erecta, pedunculata; involucrum 8–13 mm longum, campanulatum, vix vel haud purpureum, phyllariis ca 40, ellipticis vel ovatis, prope medium latioribus 1.5–2.5 mm latis, apice obtusis vel rotundatis vel raro subacutis; phyllariorum apices plerumque ciliato-fimbriati; areae terminales fuscatae sagittatae, subnigrae; phyllaria exteriora, et bracteae paucae sub involucrum sitae, lanceolatae, 0.7–1.2 mm latae; flores 50–60, 1.5–2 cm longi; paleae 12–14 mm longae; achaenia subfusiformia, 6–7.5 mm longa, laevia vel versus apicem tenuem rostriformen scabrella, ca 15-costata; pappus setis capillaribus, sordidis, 6–7 mm longis, barbellatis.

CHIAPAS: Near San Cristóbal Las Casas, elev. ca 2100 m, 5 Jul 1964, *D. E. Breedlove 6011,* 11 Jun 1960, *R. M. King 2804* (MICH, type; US); Mpio. de Tenejapa, 4 Aug 1964, *Breedlove 6821,* 30 Sep 1965, *Breedlove 12526*; Mpio. de Tuxtla Gutiérrez, 29 Jan 1965, *Breedlove & Raven 20129*; Mpio. de Ixtapa, 14 Jun 1965, *Breedlove 10397*; Mpio. de Zinacantán, 1 Apr 1965, *Breedlove 9503*; Mpio. de La Trinitaria, 26 Jul 1965, *Breedlove 11309.*

GUATEMALA: HUEHUETENANGO: *Skutch 1027* (US); *Beaman 3946* (MSC); *King 3398* (MICH, US); *Breedlove 8666*; Todos Santos, elev. 2800 m, 10.6.1882, *Lehmann 1545* (US). QUICHE: San Siguán, elev. ca 1750 m, Apr 1892, *Heyde & Lux (J. D. Sm. 3393)* (US).

Tribe III. Eupatorieae

Brickellia coulteri var. **megalodonta** (Greenm.) McVaugh, comb. nov. *Brickellia megalodonta* Greenm. Proc. Am. Acad. 40 [Contr. Gray Herb. II. 28] : 34. 1904.

Brickellia coulteri var. *coulteri* is a plant of the Sonoran desert and elsewhere in central and southwestern Arizona, Sonora and Baja California. Robinson's concept of *B. coulteri* included plants from as far east and southeast as Coahuila, Puebla, Aguascalientes and Colima. Most of the specimens from southwestern Mexico, however, seem to belong to another variety, which was treated by Robinson as an independent species. The differences between var. *megalodonta* and var. *coulteri* are not great. The leaves in var. *megalodonta,* on the average, are larger, with more prominent acuminate tips; the peduncles are a little longer and more delicate, the outer phyllaries a little narrower and fewer in number, and the herbage often pilose and less strongly stipitate-glandular. Robinson described the heads of *B. coulteri* as "ca. 17-floris," but this seems to be an extreme, not an average number; in specimens examined by Robinson himself (e.g. *Palmer 62* in 1887) the number of flowers varies from 12 to 15. The number of flowers in var. *megalodonta* is consistently about 12, whereas many individuals of var. *coulteri* have 15 or more flowers. I do not find consistent differences in corolla-length between the two varieties; although according to Robinson the corollas in var. *coulteri* are 8.2 mm long, I have not seen any longer than 7 mm; in var. *megalodonta* they are 6–6.5 mm long.

Brickellia extranea McVaugh, sp. nov.

Perennis, erecta, scabrida, e radice crassa lignosa, caulibus paucis foliosis usque ad 1 m altis, superne corymbo 6–15 cm longo terminata; folia rigidiuscula, alterna, subtus copiose globulifera, plusminusve triplinervia, mediana maxima, oblonga vel elliptica vel lanceolata, 5–7 cm longa, 0.7–1.8 cm lata, obtusa vel subacuta (apice brevicalloso), integra vel utroque latere 1–4-dentata, basi cuneatim producta, petiolo 3 mm longo vel breviore; folia superiora magnitudine decrescentia, lanceolata vel linearia, 2–4 cm longa; capitula 12–14 mm longa, 11–12-flora, erecta, subumbellatim disposita, pedunculis gracilibus 4–10 mm longis; involucrum 8–10 mm longum, campanulatum, phyllariis 3–5-seriatis, exterioribus gradatim brevioribus, valde 3–6-costatis; phyllaria interiora (ca 8) 7–9 mm longa, 1–1.5 mm lata, subglabra, inaequalia, oblonga vel elliptica, marginibus membranaceis, apicibus truncatis vel retusis, mucronatis; phyllaria media exterioraque (8–10) oblonga vel ovata, cuspidato-acuminata, pubescentia ciliataque; corolla glabra, viridula vel subpurpurascens, 6–7.5 mm longa, supra basin dilatatam fere linearis, lobis ovato-triangularibus 0.5–0.7 mm longis globuliferis; antherae prope corollae medium positae 1.5–1.8 mm longae, basi auriculatae, appendicibus ovatis 0.3 mm longis; styli ramuli 1–1.5 mm exserti; achaenia clavato-columnaria 3.5–3.8 mm longa, teretia vel compressa, saltem apicem versus appresse pubescentia, costulis 10 vel ultra convexis, confertis; pappi setae ca 20 albae, confertae, subplumosae 5.5–6.5 mm longae, barbulis inferioribus longioribus; receptaculum glabrum, per achaeniorum cicatrices asperatum.

JALISCO: Mpio. de Mezquitic, 5 km E of Rancho El Mortero, in pine-oak forest, elev. 2200 m, 5 Nov 1963, *Rzedowski 17698* (MICH, type); 8–10 km SE of El Mortero, elev. 2450 m, 5 Nov 1963, *Feddema 2449.*

Unknown except from the above collections, this species is superficially very like *Brickellia adenolepis,* with which it may be contrasted as follows:

1. Phyllaries 30–35, the outer ones usually bearing some dark, marginal, stipitate glands; pappus evidently plumose, the hairs on the bristles 0.2–0.4 mm long, more than twice as long as the thickness of the bristles. *B. adenolepis.*
1. Phyllaries 16–21, ciliate but eglandular; pappus barbed or subplumose, the hairs seldom as much as 0.2 mm long, hardly twice as long as the thickness of the bristles. *B. extranea.*

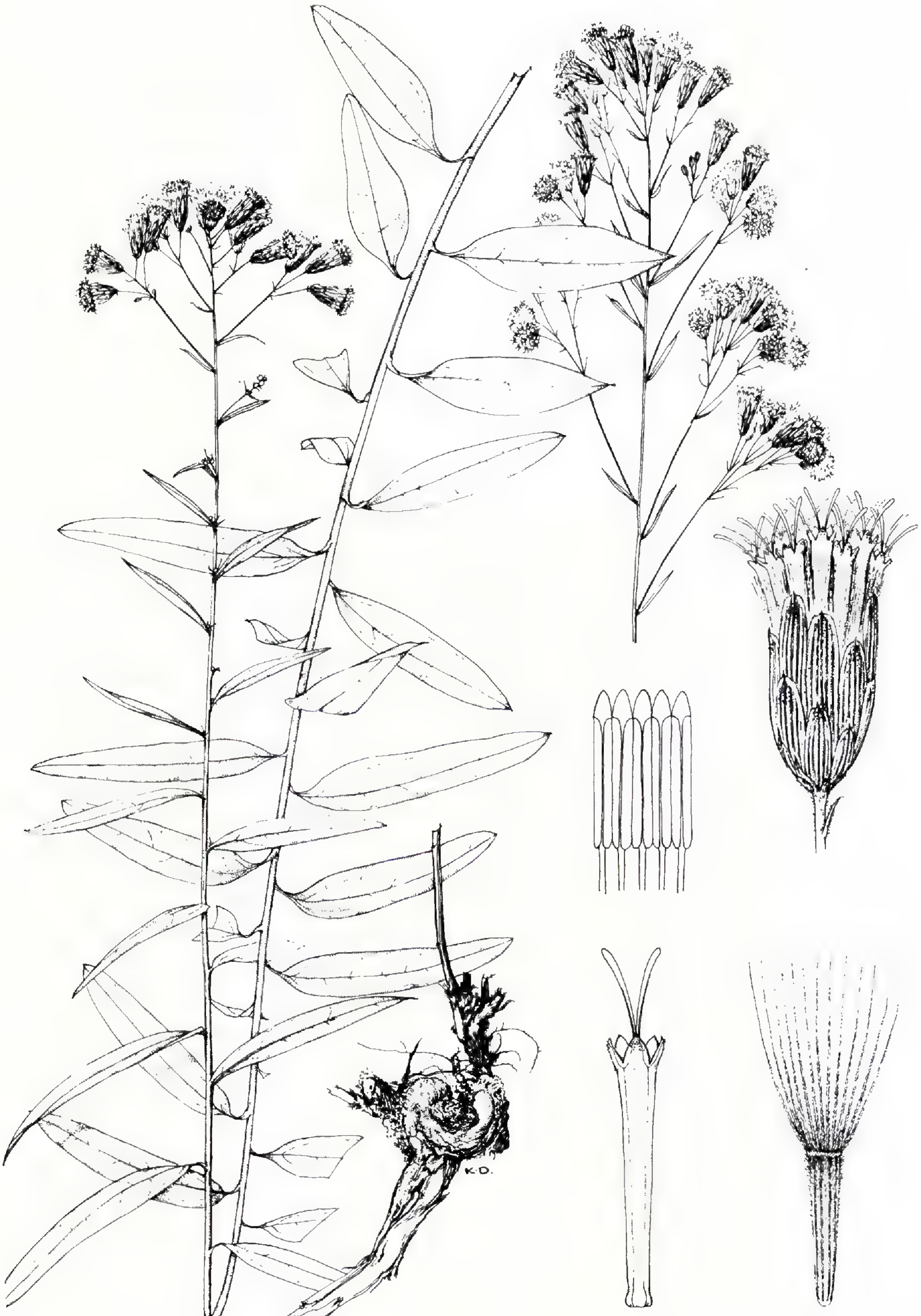

FIG. 6. *Brickellia extranea.* Flowering plant, ca X ½ (*Rzedowski 17698,* type). Inflorescence, ca X ½ (*Feddema 2449*). Head, ca X 3; corolla and achene, ca X 5; anthers, ca X 10 (all from the type).

Brickellia glandulosa (Llave) McVaugh, comb. nov. *Rosalesia glandulosa* La Llave in Ll. & Lex. Nov. Veg. Descr. 9. 1824. *Brickellia pacayensis* Coult. Bot. Gaz. 16: 98. 1891.

This is one of the easiest species of *Brickellia* to recognize, because of the large, oblong to obovate, densely glandular outer phyllaries. Robinson relegated *Rosalesia glandulosa* to the synonymy of *Brickellia squarrosa,* but a specimen from LaLlave's herbarium, bearing an original label "Rosalesia glandulosa Llave" is evidently the same plant that has been called *Brickellia pacayensis.* The specimen is now at Geneva (G) among the plants received from Lambert's herbarium, and marked by Lambert "Mexico Herb. La Llave." The specimen agrees well with the description in the protologue of *Rosalesia glandulosa,* where the "calix" was characterized as follows: "foliolis constat 8–12 acutis, erectis, aequalibus, striatis, ad medium usque duplici foliorum ordine cinctis, quae ovata sunt, apiceque revoluta; omnibus glanduloso viscosis." The type-locality was "in pascuis S. José del Corral," i.e. in the region of Córdoba, Veracruz.

Brickellia jaliscensis McVaugh, sp. nov.

Perennis, erecta, 0.6–1.25 m alta, habitu *Eupatorio dryophilo* persimilis, caulibus subsimplicibus, e caudice lignoso oriundis; caules, petioli pedunculique pubescentes, folia venis exceptis fere glabra, globulifera, rigide coriacea, subsessilia, late ovato-cordata, 2.5–5.5 cm longa, 2–5 cm lata, acuta vel apice pungenti et breve acuminato, vel infima obtusa, omnia 3(–5)-nervata, venulis in siccitate elevatis, reticulatis; petioli 1–3 (–6) mm longi; foliorum paria 10–15; inflorescentia paniculiformis paucicapitata 15–30 cm longa, ramis ascendentibus 5–10 cm longis, bracteatis, infimis exceptis alternis; capitula quoque ramo 1–7, erecta, late campanulata, 20–27-flora, 12–18 mm longa, pedunculis 1–2 (–4) cm longis suffulta; involucrum 10–14 mm longum, purpurascens, phyllariis 40–45, exterioribus gradatim brevioribus, abrupte pungentibus vel cuspidatis, ca 7-costulatis; phyllaria interiora ca 13, 2-seriata, 8–12 mm longa, 1–1.7 mm lata, late linearia vel elliptica, obtusa vel abrupte acuta, glabra sed ciliata, 2–4-costulata, marginibus membranaceis; flores flavidi, viriduli, vel ex purpureo viriduli; corollae glabrae, 8–9 mm longae, lineares, ca 0.5 mm diametro, distaliter parum angustatae, lobis ovatis 0.5 mm longis, globuliferis; antherae prope corollae medium positae, 1.5–2.2 mm longae, basi auriculatae, appendicibus ovatis 0.4–0.5 mm longis; styli ramuli 2–3 mm exserti, clavati, purpurascentes; achaenia clavato-columnaria, 3.3 mm longa, hirsuta pilis pallidis 0.5 mm longis, obtuse ca 10-costata; pappi setae 35–40 albae, crassae, barbellatae, 7–8.5 mm longae; receptaculum glabrum, per achaeniorum cicatrices cucullatas asperatum.

TYPE: JALISCO: In pine forest, mountains 20–25 km SSE of Autlán, 6–16 km above Ahuacapán, elev. 1500–2000 m, 22–23 Nov 1959, *McVaugh & Koelz 934* (MICH).

A species unlike most other Mexican Brickellias in appearance, and strongly reminiscent of *Eupatorium dryophilum* in the general habit, in the size and shape of the nearly sessile leaves, and the characters of the involucre.

Additional specimens examined:

ZACATECAS: Mountains ca 20 km W of the road-junction S of Jalpa, road to Tlaltenango, sheltered E-facing valley in oak forest, elev. 2500 m, 23 Dec 1970, *McVaugh 25629.*

AGUASCALIENTES: Sierra del Laurel, ca 16 km SE of Calvillo, 2000–2300 m, 4 Nov 1959, *McVaugh & Koelz 181.*

JALISCO: Cerro de Tequila, elev. 2560 m, 23 Dec 1967, *L. M. Villarreal de Puga 1070;* Talpa de Allende, Sierra de Cuale, 1800–2250 m, 19–21 Nov 1952, *McVaugh 14249;* Talpa, headwaters of Río de Talpa, 1200–1700 m, 23–25 Nov 1960, *McVaugh 21342;* Autlán, Sierra de Manantlán, south slope, 1700 m, 7 Nov 1952, *McVaugh 13979;* Tecalitlán, Sierra del Halo, 1700–1800 m, 3 Dec 1959, *McVaugh & Koelz 1378.*

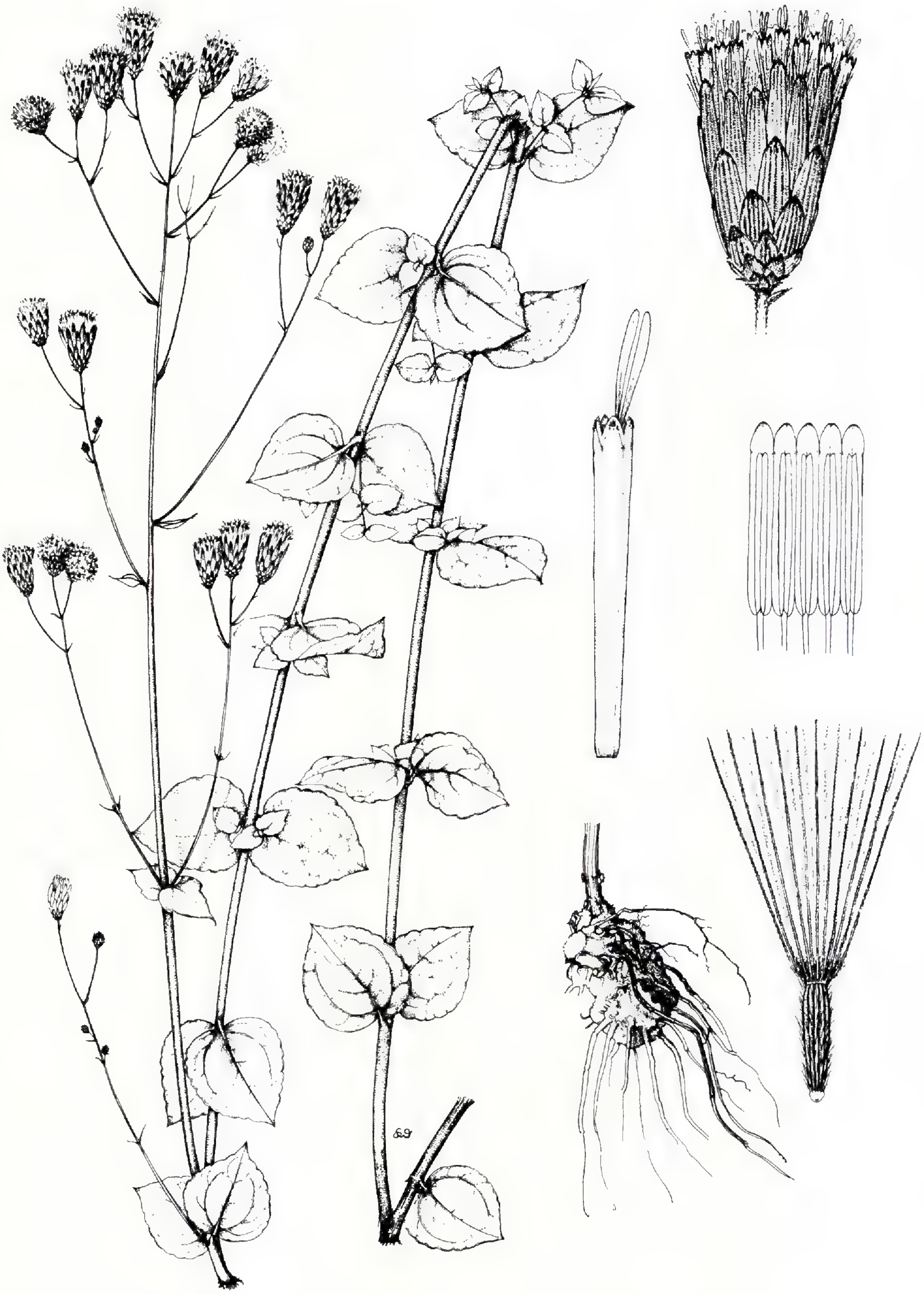

FIG. 7. *Brickellia jaliscensis* (*McVaugh & Koelz 934,* type). Flowering plant, X ½; head X 2; corolla and achene, X 5; anthers, X 10.

Brickellia magnifica McVaugh, sp. nov.

Frutex, vel basi praecipue lignosa, caulibus pluribus 2–2.5-metralis, arcuatis, capitulis cernuis; caules, pedunculi, petioli foliique venae pubescentes, phyllaria saltem exteriora fimbriato-ciliata, folia fere glabra et laevia, vel scabridula; folia opposita, ovata, principalia 8–17 cm longa, 5–10 cm lata, 3-nervata vel triplinervia, anguste acuminata, basi rotundata vel subcordata, et ibidem saepe cuneatim et aliquando inaequaliter in petiolos 2–4 (–7) cm longos producta; margines laterales utroque latere

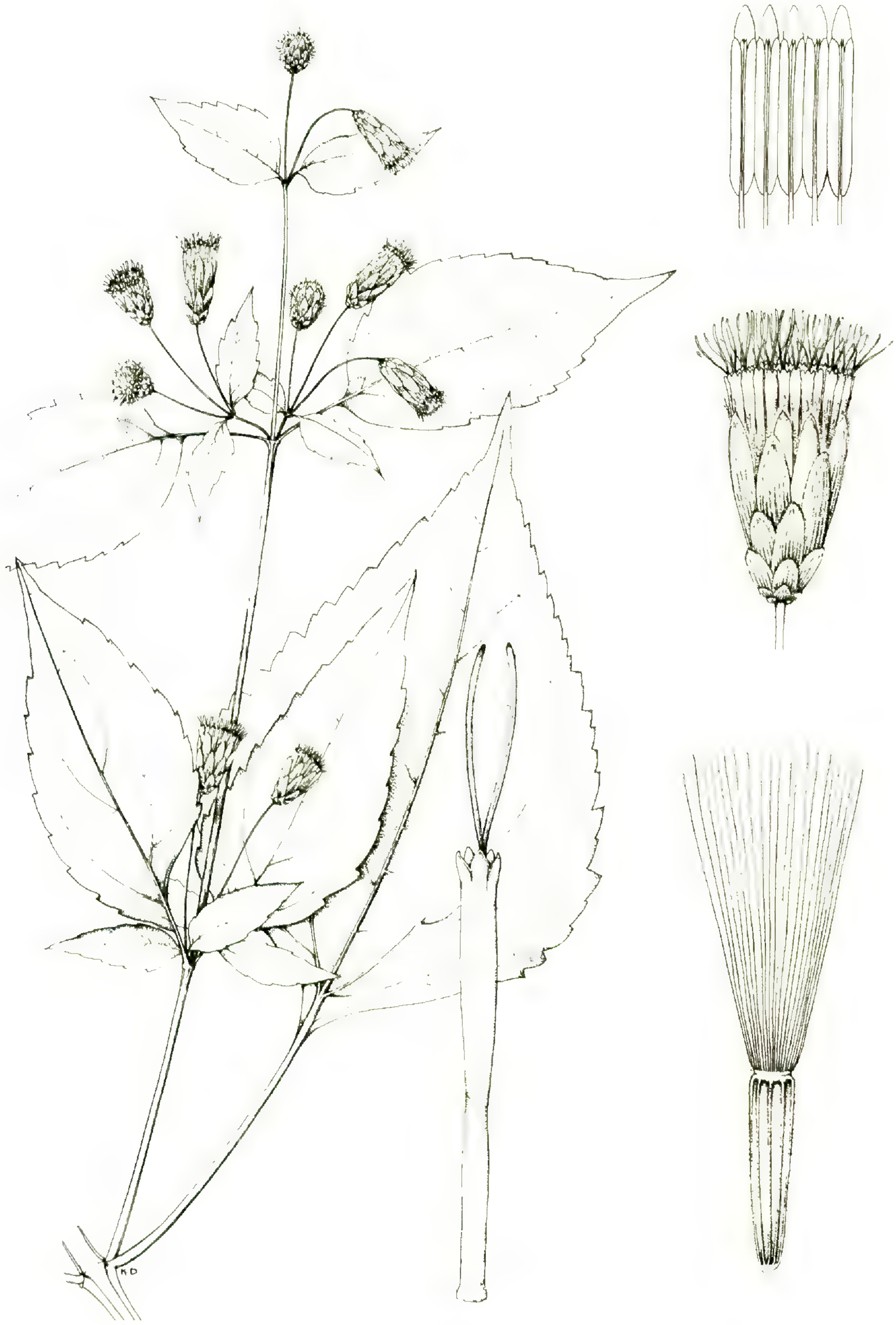

FIG. 8. *Brickellia magnifica* (*McVaugh 11737*, type). Main lateral branch of flowering inflorescence, X ½; head, X 1.5; corolla and achene, X 5; anthers X 7.5.

dentibus 10–20 grosse serratae; ramuli florentes oppositi, graciles, ascendentes, 15–30 cm longi, 2–4-nodi, capitulis quoque nodo vel nodo terminali 2–6, umbellatim dispositis, cernuis, pedunculis gracilissimis 2–3 cm longis; capitula campanulata 2–2.5 cm longa, 27–30-flora; involucrum 16–20 mm longum, viridi-stramineum vel ex purpureo viridulum, phyllariis tenuibus sed elasticis 25–35, exterioribus valde decrescentibus; phyllaria interiora 13–15, achaenia subtendentia, late linearia vel oblongo-elliptica, 15–18 mm longa, 1–3 mm lata, marginibus membranaceis, apicibus tenuibus, abrupte acutis; phyllaria exteriora ca 3-seriata, 5–9-costulata, obtusa et saepe apicibus fissa; extima minima ovata, acuta vel breve aristata; flores flaviduli vel ex purpureo flaviduli; corolla (9–) 11–12 mm longa, anguste linearis sed basi dilatata, lobis anguste triangularibus 0.7 mm longis; antherae 3 mm longae, basi auriculatae, appendicibus late ovatis 0.5 mm longis; styli ramuli flavidi, conspicui, ca 5 mm exserti, pro genere graciles, vix clavati; achaenia 4.5–5 mm longa, clavato-columnaria, pallide brunnea, fere glabra, ad angulos praecipue minute strigosa, costulis elevatis obtusis 9–10; pappi setae albae fragilissimae 40–50, 9 mm longae, minute barbellatae, subplumosae; receptaculum glabrum, per achaeniorum cicatrices multum asperatum.

JALISCO: Nevado de Colima, barranca in fir forest on the SE slopes, elev. 2700 m, 3 Apr 1951, *McVaugh 11737* (MICH, type); Nevado de Colima, *McVaugh 10018, 11660;* Autlán, Sierra de Manantlán, *McVaugh 10263.*

Among the shrubby species of *Brickellia* with opposite leaves, *B. magnifica* is unique in having large drooping heads, scanty non-glandular pubescence, long-petiolate leaves, obtuse or abruptly pointed (not taper-pointed) and essentially glabrous phyllaries, glabrous receptacle and nearly glabrous achenes. It is known only from densely wooded barrancas in fir or pine-fir forests, at elevations of 2400 to 2700 m, where it flowers in March and April.

Brickellia rapunculoides (DC.) McVaugh, comb. nov. *Stevia rapunculoides* DC. in DC. Prodr. 5: 124. 1836. *Eupatorium dasycarpum* A. Gray, Proc. Am. Acad. 22: 420. 1887. *Eupatorium rapunculoides* (DC.) Rob. Proc. Am. Acad. 42: 45. 1906.

When describing *Eupatorium dasycarpum,* Gray stated "The plant has the aspect, inflorescence, and involucre of a *Kuhnia,* or of some *Brickelliae.* The achenes are strongly pentangular, yet now and then with a secondary nerve on one or two of the faces." In the abundant material now available, the number of ribs on the achene usually varies from 6 to 8; it is occasionally as small as 5 or as large as 9. The plant is evidently out of place (on the basis of this one character) in both *Eupatorium* and *Brickellia.* In other respects, as noted by Gray, it seems closer to a number of species of *Brickellia.* It is similar, for example, to *B. amblyolepis* Rob., a species of Morelos and Guerrero. In the latter the achenes are mostly 10-ribbed; they are strigose and glandular as in *B. rapunculoides* and the inequality of the pappus-bristles is even more marked than in that species.

Brickellia secundiflora (Lag.) A. Gray, var. **monticola** McVaugh, var. nov.

A var. *secundiflora* pedunculis dense pilosis non glandulosis, a var. *nepetifolia* pedunculis non glandulosis, capitulis 20–30-floris non 10–19-floris differt.

JALISCO: Nevado de Colima, in oak-pine forest, SE slopes, elev. ca 2000 m, 4 Apr 1951, *McVaugh 11794* (MICH, type); pine forest 2–3 km E of Tapalpa, elev. 2100–2200 m, 30 Oct 1960, *McVaugh 20528;* above Amacueca, toward Tapalpa, in oak forest, 2100–2250 m, 2 Nov 1960, *McVaugh 20613A.*

MICHOACAN: Cerro Tancítaro, *Hinton 15695* (US); Cerro Patamban, *Nelson 6554* (US); 8 km S of Uruapan, elev. 1830 m, 11–15 Oct 1961, *King & Soderstrom 4763;* Zitácuaro to Mango, elev. 2000 m, 24 Oct 1938, *Hinton 13396.*

Typical *Brickellia secundiflora,* as interpreted by Robinson, is a viscid-glandular plant of eastern Mexico, known from the Valley of Mexico and thence northeastward and southeastward. In Nueva Galicia the species is represented chiefly by the var. *nepetifolia* (H.B.K.) Rob., which ranges from western and southern Durango to

Zacatecas, Aguascalientes, central and northern Jalisco, Guanajuato (Santa Rosa, *Humboldt & Bonpland!*, the type) and Michoacán. In this variety the stipitate glands are usually confined to the peduncles where they are relatively inconspicuous among the long eglandular hairs. The flowers are usually 12–15 (sometimes as few as 10 or as many as 19) in a head.

The var. *monticola* apparently occupies a somewhat more southerly range than that of var. *nepetifolia,* and is found, on the average, in higher and more humid situations. The branches, foliage and peduncles are hirsute, nearly or quite without stipitate glands; the leaves are mostly broadly ovate-cordate, 5-10 cm long; the flowers are 20–30 in a head.

Carminatia recondita McVaugh, sp. nov.

Annua, erecta, foliis oppositis; foliorum paria 5–8, plerumque plantae infra medium posita; folia late ovata, petiolata, palmatim 3(–5)-nervata, serrulata vel dentata; capitula (in spica elongata disposita) subcylindrica ca 11-flora, phyllariis ca 20, exterioribus gradatim brevioribus, intimis 8 subaequalibus, angustis, acutis; corolla viridula, anguste tubiformis; antherae pallidae, inclusae, basi acutae vel obtusae, apice appendiculatae; styli ramuli filiformes, 1–1.5 mm exserti; achaenia sublinearia, ca 5-angulata; pappi setae 9–13 albae, basi coalitae, plumosae, quam corollae paullo breviores; cum specie altera (*C. tenuiflora*) in characteribus supra dictis bene congruens, aliis differt:

1. Corolla anguste linearis vel apicem versus angustata, (5.5–) 6–7 (–7.5) mm longa, complanata minus quam 0.5 mm lata; antherae, appendicibus inclusis, 0.7–0.8 mm longae; achaenia 4–5.3 mm longa, apice glabra truncataque, pappo sessili; involucrum 11–13.5 mm longum; spica plerumque breve pedunculata, pedunculo 5–15 cm longo, saepe spicae tertiam partem aequanti; spica plerumque non secunda, capitulis sub anthesi saepe ascendentibus. *C. tenuiflora.*

1. Corolla apicem versus manifeste dilatata, 7.5–9 mm longa, complanata 0.7–1 mm lata; antherae, appendicibus inclusis, 1.1–1.4 mm longae; achaenia 5.5–7 mm longae, ad apicem sub pappo in collum brevem pilosum contracta; involucrum 14–17.5 mm longum; spica plerumque longe pedunculata, pedunculo 10–30 cm longo, spicam saepe aequanti (pedunculi brevissimi spica 2-plo breviores, longissimi spica sesquilongiores); spica saepe secunda, capitulis sub anthesi patentibus vel cernuis. *C. recondita.*

NAYARIT: 16 km SE of Ahuacatlán, road to Barranca del Oro, precipitous rocky S-facing slopes, wooded ravine, elev. 1100–1300 m, 17–18 Nov 1959, *McVaugh & Koelz 804* (MICH, type); NW of Ahuacatlán, *Cronquist 9601;* N of Compostela, *McVaugh & Koelz 511.*

JALISCO: La Cuesta, Mpio. Talpa de Allende, elev. 800 m, *McVaugh 21135;* Mpio. de Tecalitlán, 15 km E of Pihuamo, *Feddema 2203;* Barranca de Beltrán, NE of Tonila, *McVaugh 24957*; Barranca del Río Santiago [near Guadalajara], *Diguet 86.*

COLIMA: Along Río Salado, 8 km S of Colima, elev. 400 m, *McVaugh & Koelz 1102;* Alzada, 4 Nov 1910, *Orcutt 4655* (GH).

MICHOACAN: 22 km N of Buenavista Tomatlán, *McVaugh 24782;* 35 km S of Jiquilpan, *King & Soderstrom 4600*; 3 km below Tacámbaro, elev. 1520 m, *Moore et al. 5603*; Mpio. de Chinicuila, Villa Victoria, 1200 m, 15 Nov 1938, *Hinton 12567* (GH).

OAXACA: 9 mi SE of Tapanatepec, *Breedlove & Raven 13703.*

CHIAPAS: Mpio. de Tuxtla Gutiérrez, *Breedlove & Raven 13346, 13498;* Mpio. de Ixtapa, *Breedlove 13826;* 3 mi W of Los Amates, E of Chiapas-Oaxaca border, *Cronquist 9667.*

This newly described species is a plant of the Pacific slope of western Mexico, growing mostly at elevations between 400 and 1500 m, from southern Nayarit to the coastal mountains of Jalisco, Colima, and Michoacán. What seems to the the same species occurs in Oaxaca and Chiapas. The first-known species of the genus, *C. tenuiflora* DC., is found primarily in the interior uplands of western Mexico, ranging from southern Arizona and the cape region of Baja California to Jalisco, Guanajuato, Michoacán, Edo. de México, Hidalgo and Guerrero. The type (*Méndez* in herb. G-DC.!) was from León, Guanajuato.

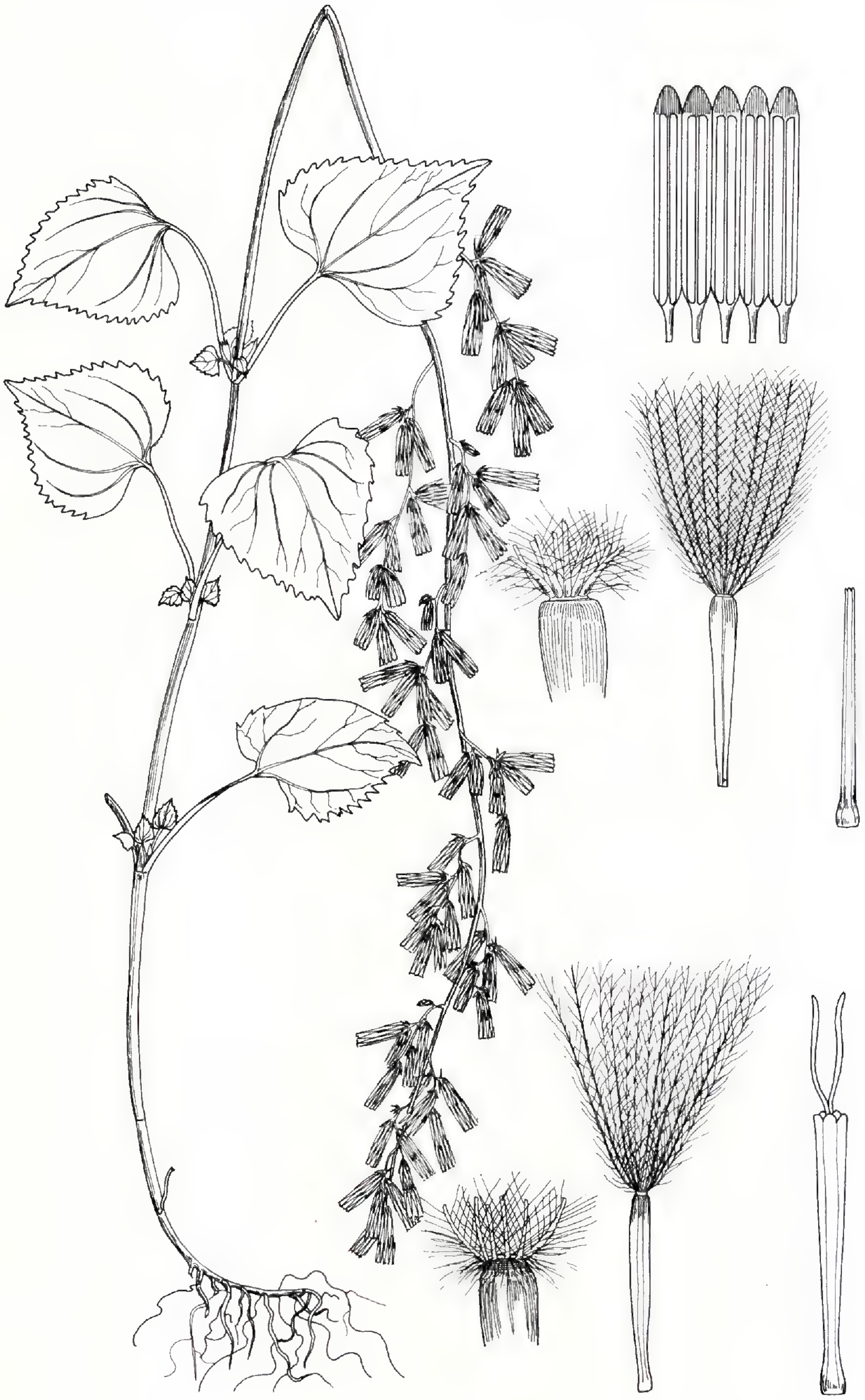

FIG. 9. *Carminatia.* Flowering plant of *C. tenuiflora,* ca X 7/16 (*McVaugh 19527*); anthers, ca X 25; corolla and achene, ca X 4.5; part of achene and base of pappus, ca X 11. Lower right, *C. recondita* (*McVaugh & Koelz 804,* type). Corolla and achene, ca X 4.5; part of achene and base of pappus, ca X 11. Drawn by Humberto Sánchez Córdova.

Carphochaete gummifera McVaugh, sp. nov.

Fruticulus glaber et gummosus, resinoso-punctatus, ramulis hornotinis 20–40 cm altis; folia in axillis prolificantia, anguste linearia, 2.5–5 cm longa, 1.3–2.5 mm lata, obtusa, carnosiuscula, plano-convexa vel supra sulcata, 0.5–0.8 mm crassa; internodi

FIG. 10. *Carphochaete gummifera* (*McVaugh 25617*, type). Flowering plant, X ½; flowering head, X 1.5; corolla, achene and style, X 2.5; anthers, X 7.5.

superiores plerumque elongati, caulis pars superior inflorescentiam laxam paniculiformem formans; capitula pauca, 2.5–3 cm longa, nunc in axillis superioribus sessilia vel brevipedunculata, nunc pedunculata, terminalia, solitaria vel quoque ramo 2–3, pedunculis ad 2.5 cm longis; inflorescentiae bracteae 2 cm longae vel breviores, forma foliis caulinibus similes; involucrum subcylindricum (in alabastro fusiforme), 15–16 mm longum, ca 3 mm crassum, phyllariis 7–10, lanceolato-linearibus vel elliptico-linearibus, acutis vel attenuatis, apicibus angustis pungentibus, marginibus plerumque angustis hyalinis, interdum glanduloso-ciliatis; phyllaria intima 4 (flores subtendentia), ca 2 mm lata; phyllaria exteriora plerumque paria 2 decussata 6–12 mm longa formantia; flores lilacini; corolla 16–17 mm longa, glabra, tubo longo tenui in faucem brevem infundibuliformem sensim ampliato, lobis 5 ellipticis acutis 4.5–5 mm longis, 1.5–1.8 mm latis; antherae 3.5 mm longae, basi subauriculatae, appendicibus obtusis, oblongis, 0.6 mm longis; styli ramuli ca 10 mm longi, exserti; achaenia 10–11 mm longa, subteretia, apice 0.7 mm crassa, strigosa, ad basin callosam sensim angustata; pappus biseriatus, aristis attenuatis planis inaequalibus 7–10, (7–) 11–12 mm longis, hyalino-marginatis, et squamulis hyalinis exterioribus 1–3, 1.5 mm longis.

ZACATECAS: Grassy openings in oak forest, steep slopes near the summits of the mountains between Jalpa and Tlaltenango, elev. 2300–2500 m, 22 Dec 1970, *McVaugh 25617* (MICH, type). Known only from the type-collection.

This species superficially resembles *Carphochaete grahamii* A. Gray, which is widespread in the Central Plateau of Mexico and the adjacent mountains, from Durango to the State of Mexico. *C. grahamii* differs most obviously in having the phyllaries long-pilose at least near the tips, which are cuspidate rather than merely acute or attenuate; and in having flat leaves which are mostly broader than linear, 2–5 mm wide or more. The gummy exudate that is characteristic of *C. gummifera* is sparingly if at all developed in *C. grahamii.*

Eupatorium

1. The Species of "*Eupatoriastrum.*"

The genus *Eupatoriastrum,* as originally described by Greenman (Proc. Am. Acad. 39 [Contr. Gray Herb. II. 25]: 93. 1903), included but one species, *E. nelsonii.* Because of the eupatorioid styles Greenman placed the new genus "provisionally" near *Eupatorium,* from which he distinguished it by the uniformly chaffy receptacle. Twenty years later Robinson (Contr. Gray Herb. II. 68: 34. 1923) referred a second species to *Eupatoriastrum,* saying of this second species and of *E. nelsonii* "neither of these coarse herbs with loose inflorescence of large heads and with copiously paleaceous receptable possesses close resemblance or shows near approach to any undoubted species of *Eupatorium.*" Fifteen years after this Blake (Jour. Wash. Acad. 28: 479. 1938) described a third species, *Eupatoriastrum opadoclinium.* Of this Blake commented as follows:

"In external appearance this is very similar to the section *Cylindrocephala* of *Eupatorium* and utterly distinct from the two species of *Eupatoriastrum* hitherto known, [but] . . . every flower in the head is subtended by a pale, and it is necessary to refer the species to *Eupatoriastrum* or to suppress the latter genus, a course which seems unjustified." Blake pointed out further that the new species, "in the texture and convexity of its phyllaries," was very similar to the species of the Brazilian section *Chromolaena* of *Eupatorium* "which makes a definite approach to *Eupatoriastrum* in having the receptacle paleaceous here and there but never, apparently, throughout as in *Eupatoriastrum.*"

Now the discovery of a fourth species with the characters of *Eupatorium* but with paleaceous receptacle makes it desirable to consider again the standing of *Eupatoriastrum* as a genus. Apparently there is nothing to mark the genus except the presence, throughout the receptacle, of narrow scarious pales about as long as the flowers. This in itself is not a very good generic character unless it be correlated with others. As noted above, some other species that are "undoubted species of *Eupatorium*" have the receptacle partly paleaceous. In the related genus *Ageratum* botanists have generally recognized a series of species with receptacle naked, and another series with receptacle paleaceous. In some eupatorioid species (e.g. in *Eupatorium polybotryum* DC.) there is a tendency for the innermost phyllaries to be transformed into pales. In others (e.g. *E. altiscandens,* sect. *Hebeclinium*), the heads are relatively few-flowered, but almost every flower is subtended by a pale. It would seem that in various eupatorioid lines the paleaceous receptacle has developed, or perhaps more probably has persisted through evolutionary change.

If it were possible to show that *Eupatoriastrum* comprised a homogeneous group, united by several characters in common, then perhaps it should be recognized. The four known species, however, seem to represent several evolutionary lines. As Blake stated, *E. opadoclinium* bears a strong superficial resemblance to the section *Cylindrocephala* (e.g. to such species as *Eupatorium oerstedianum, E. ovaliflorum, E. glaberrimum,* etc.). The other three species bear a strong habital resemblance to one another, but differ in other ways. The pappus in *E. triangulare,* for example, consists of numerous, closely packed, coarse and persistent bristles; in *E. nelsonii* and in the new species described below the bristles are less numerous, rather widely spaced, delicate and soon deciduous. These differences correspond to those that mark different series of species in *Eupatorium,* but they do not suggest close relationship between *E. triangulare* and the other two species. Furthermore the anthers in the new species are quite typical of those in *Eupatorium;* the appendages are thin, flat, oblong obtuse scales projecting well beyond the tips of the anthers; in *E. nelsonii* the appendages are present but short and slightly thickened and spreading; in *E. triangulare* the tips of the anthers are essentially exappendiculate, thickened and recurved, almost truncate, as in the supposed genus *Ophryosporus.* Perhaps these anther differences mark an evolutionary series, but they do not provide convincing evidence of generic independence. Similar series may be found in other species-groups in *Eupatorium.* Although *Eupatoriastrum* offers a convenient pigeonhole for the filing of any species of *Eupatorium* with paleaceous receptacle, it does not seem to constitute a natural evolutionary group.

The following synopsis contrasts the four species discussed above:

1. Leaves sessile and subcordate, lanceolate, 2–5 cm wide; involucre campanulate-cylindric; Chiapas. [*Eupatoriastrum opadoclinium* Blake, Jour. Wash. Acad. 28: 479. 1938].
   Eupatorium opadoclinium (Blake) McVaugh, comb. nov.
1. Leaves evidently slender-petiolate, ovate, deltoid or suborbicular, mostly 10–25 cm wide; involucre campanulate or hemispheric or the phyllaries almost rotate.
   2. Leaves ovate, rounded at base; panicle-branches and phyllaries eglandular; Chiapas. [*Eupatoriastrum nelsonii* Greenm. Proc. Am. Acad. 39: 93. 1903]. Not *Eupatorium nelsonii* Rob.
      Eupatorium ultraisthmium McVaugh, nom. nov.
   2. Leaves cordate, mostly deltoid or suborbicular; panicle-branches and phyllaries glandular.
      3. Heads subtended by 15-20 loosely spreading, narrow, attenuate, copiously glandular, foliaceous bracts 1–2 cm long, longer than or about equalling the phyllaries; phyllaries 75–100 or more, subequal, similar to the bracts; pappus delicate, the 15-20 bristles soon deciduous; anthers (1.6–) 2.2 mm long with flat blunt appendages 0.3–0.5 mm long; Chiapas. **Eupatorium corvi** McVaugh, sp. nov.
      3. Heads not involucrate, the 25–40 phyllaries evidently graduated in length, not foliaceous, the outermost glandular on the backs, the inner ones nearly smooth; pappus persistent on the achenes, consisting of about 40 coarse bristles; anthers 1.5–1.7 mm long, truncate, essentially exappendiculate, with thickened outcurled tips; Nayarit to Oaxaca. [*Eupatoriastrum triangulare* (DC.) Rob.].
         Eupatorium vitifolium Klatt.

Eupatorium corvi McVaugh, sp. nov.

Herba (ut videtur) grossa usque ad 2-metralis, copiose glanduloso-pubescens; folia asperiuscula, late ovato-cordata vel suborbicularia, 7–15-dentato-lobata, basi palmatim (5–) 7-nervata, caulinia (12–) 20–30 cm long, (12–) 20–25 cm lata, lobulis terminalibus majoribus, deltoideo-acuminatis, 3–6 cm longis latisque; lamina basi cordata, marginibus denticulatis, petiolis 2–8 cm longis; panicula terminalis diffusa usque ad 50 cm longa vel ultra, capitulis magnis paucis, ca 200-floris, usque ad 2 cm longis, 3 cm latis, longe pedunculatis, basi bracteatis, bracteis 15–20 appressis attenuatis foliaceis 1–2 cm longis, 1.5–3 mm latis suffultis; phyllaria 100–125, lanceolata, 10–12 mm longa, subaequalia, basi curvata rigidaque, apicibus foliaceis, attenuatis, glandulosis, patentibus; corolla 5.5–7 mm longa, sublinearis; antherae 1.8–2.2 mm longae, appendicibus *Eupatorii* modo terminatae; styli rami filiformes; achaenia 2.5 mm longa, strigosa, 5-angulata; pappi setae 15–20 fragiles, deciduae; receptaculum paleaceum, paleis scariosis, perangustis, attenuatis, 1 cm longis.

Species botanico indefesso Peter Hamilton Raven (1936–), qui mecum humanissime plantas siccas chiapenses communicavit, nominavi.

Probably a coarse herb, copiously glandular pubescent, with loosely flowered terminal panicle; upper stems and panicle-branches, petioles and veins of the lower leaf-surface pilose with flaccid pale multicellular hairs which are prevailingly eglandular on the leaves, gland-tipped in the panicles; phyllaries and involucre-like bracts densely glandular; herbage abundantly resinous-dotted; leaves at maturity rough-pubescent on both sides, broadly ovate-cordate to suborbicular, palmately (5–) 7-veined at base, those in the panicle about 10 cm long, the larger ones 20–30 cm long and 20–25 cm wide, with 7–15 small deltoid lobes, the terminal lobes deltoid-acuminate, 4–6 cm long and wide, slightly larger than the adjacent lateral ones; base cordate with rather narrow sinus; margins concave between the lobes, and sharply denticulate; panicles with ascending branches up to 20–40 cm long, compound, alternately branched, leafy-bracteate, bearing few large heads (up to 2 cm long and 3 cm wide) on naked or bracteate peduncles (1.5–) 3–9 cm long and about 1 mm thick; flowers recorded as "orange" or "white"; involucre in anthesis broadly bowl-shaped, up to 1.5 cm high and 2.5 cm wide, subtended at base by 15-20 appressed or loosely spreading lanceolate attenuate bracts that are a little larger than but otherwise indistinguishable from the other phyllaries (except by position), and merge imperceptibly with the phyllaries; phyllaries all about the same length, lanceolate, 1.5 mm wide or less, their curved rigid overlapping bases forming the cuplike base of the involucre, their attenuate, foliaceous, veiny and copiously glandular tips spreading or loosely reflexed; corolla very narrowly tubular-funnelform, almost linear, the triangular lobes 0.5 mm long; anthers narrowly auriculate at base, the oblong-ovate blunt appendages 0.3–0.5 mm long; style-branches exserted 5 mm or more; achenes columnar-clavate, 5-angled, nearly black, strigose above and at the callose base; pappus-bristles white, 6–7 mm long, widely separated, barbellate, coarse but very fragile, deciduous before the achenes; receptacle paleaceous, the pales scarious, flat, very narrowly linear with attenuate barbellate tip, 1 cm long, 0.2–0.3 mm wide, or the central ones almost filiform.

MEXICO: CHIAPAS: Mpio. de Venustiano Carranza: Above Finca Carmen, road from Acala to Pugiltik, 540 m, 3 Oct 1967, *Alush Shilom Ton 3029;* Rancho Nacimiento, between Chiapilla and San Lucas, wooded slope, elev. 600 m, 25 Feb 1966, *Laughlin 284* (MICH, type). Mpio. de Chiapa de Corzo: El Chorreadero, ca 9 km east of Chiapa de Corzo, elev. 750 m, 18 Oct 1965, *Breedlove & Raven 13473;* 28 Nov 1967, *Ton 3252.*

A recent collection from an area 60–70 km north of the original localities probably represents the same taxon, but the heads and flowers are smaller. The plant is a weak shrub or woody herb growing on limestone cliffs, the stems 40–60 cm high from a short fleshy-rooted caudex; the heads are about 1.5–2 cm high, the outer bracts 1–1.5 cm long, 1–2.5 mm wide, the phyllaries 70–100, the anthers 1.6 mm long, the appendages 0.3–0.4 mm long; achenes 3 mm long.

CHIAPAS: Mpio. de Ixhuatán, north of Ixhuatán, elev. 430 m, 22 Jan 1970, *Anderson & Anderson 5530.*

2. *Eupatorium* in Nueva Galicia.

Eupatorium altiscandens McVaugh, sp. nov.

Frutex, flexuoso-scandens, basi diametro ad 3–4 cm, inflorescentia excepta glaber; folia opposita vel interdum ternata, carnosula, lanceolata vel elliptica, integra, 10–17 cm longa, 3–5 cm lata, (2–) 3–4-plo longiora quam latiora, apice acuta, basi rotundata vel acuta, venis pinnatis arcuato-ascendentibus quoque latere 3–5, marginibus in petiolos 4–5 cm longos cuneatim decurrentibus; inflorescentia terminalis, 5–7 cm longa, paria ramorum lateralium 2–3, 3–4 cm longa; paniculae ramuli pedunculique dense pilis brunneis appressis pubescentes; capitula ut videtur 30 vel ultra, pedunculis bracteatis ad 5–10 cm longis; phyllaria ca 13, oblonga vel late elliptica vel obovata, marginibus saltem apices obtusos vel subacutos versus erosis; phyllaria interiora ca 5–9, 3 mm longa, 1 mm lata, vetustate paullo reflexa et extrinsecus plicata; phyllaria exteriora gradatim breviora, plusminusve biseriata; flores 16–18; corolla (in statu vivo ignota) ca 7 mm longa, tubi apicem versus strigosa (cetera glabra), tubo anguste cylindrico, in faucem sensim ampliato et eam subaequanti; faux subcylindrica, 1 mm diametro, intus annulatim hirsuta; lobi 5, ovato-deltoidei, recurvati, 1.5 mm longi vel longiores; antherae ca 2 mm longae, basi rotundatae, appendicibus late ovato-deltoideis 0.25 mm longis; styli ramuli (in alabastris) 4 mm longi, apicibus paullo compressis; achaenia columnaria, 5-angulata, glabra, paullo immatura 3.5 mm longa vel longiora; pappi setae uniseriatae ca 35, albae, rigidae, barbellatae, 5–6.5 mm longae; receptaculum 1 mm latum vel latius, paleaceum alveolatumque, alveolarum marginibus dense pilis erectis multicellularibus ad 0.5 mm longis hirsutis; paleae exteriores ca 8, oblanceolatae, 4–5 mm longae, 1 mm latae, apice laceratae; paleae interiores 5–8, longitudine exteriores aequantes, subulatae, minus quam 0.5 mm latae.

JALISCO: Mountains about 25 km SE of Autlán, above El Chante, in humid barranca-forest with *Abies, Alnus, Quercus,* elev. 1650–1850 m, probably flowering in January or February, collected when past flower, 19 Mar 1965, *McVaugh 23092* (MICH, type). Otherwise unknown.

The original collection was described in the field as a "woody vine, high-climbing on trees." Like so many Compositae in Nueva Galicia, it is not a twiner but a very long weak shrub that manages to find support among tree-branches until its own flowering branches extend beyond the crown of the tree and often cover it in profusion. This growth-habit is rather common in some genera of the Heliantheae but is rare in *Eupatorium.*

The generic position of this species may be challenged when better material becomes available. The most likely possibility would seem to be some relationship with the Senecioneae, e.g. with a genus like *Liabum,* in which the style-branches are also very long and slender, and the receptacle is often chaffy. The achenes and pappus in this new species, however, appear to be those of *Eupatorium,* and the anthers are not at all sagittate at base as they often are in *Liabum.*

Eupatorium ceriferum McVaugh, sp. nov.

Frutex arborescens 2–6-metralis, ramulis inflorescentiaque tomento coacto dealbata; folia mox glabrescentia, pilis subtus in venarum majorum axillis persistentibus; foliorum laminae triplinerves, 8–17 cm longae, 5–11 cm latae, triangulari-ovatae vel superiores minores, omnes ovatae, e basi lata truncato-subcordata (foliorum minorum rotundata), ad apicem acutum vel acuminatum (saepe falcatum) attenuatae, marginibus quoque latere dentibus 30–50 serrulatis, prope basin integris et in petiolos (2–) 4–7 cm longos abrupte decurrentibus; inflorescentia composita, rotundata vel subcorymbosa, paniculiformis, 5–15 cm longae, 8–20 cm lata; capitula ad 150 vel

ultra, 20–22-flora, pedunculis (4–) 8–20 mm longis; involucrum campanulatum, latiusculum, basi paullo incrassatum et rotundatum, 5–7 mm altum, subbiseriatum, bracteis 1–3 anguste linearibus subtentum; phyllaria principalia subaequalia ca 15, oblongo-lanceolata vel elliptica, acuta, ca 1 mm lata; corolla candida, 6–7 mm longa, anguste infundibuliformis vel tubo angusto proprio quam fauce breviore, lobis triangu-

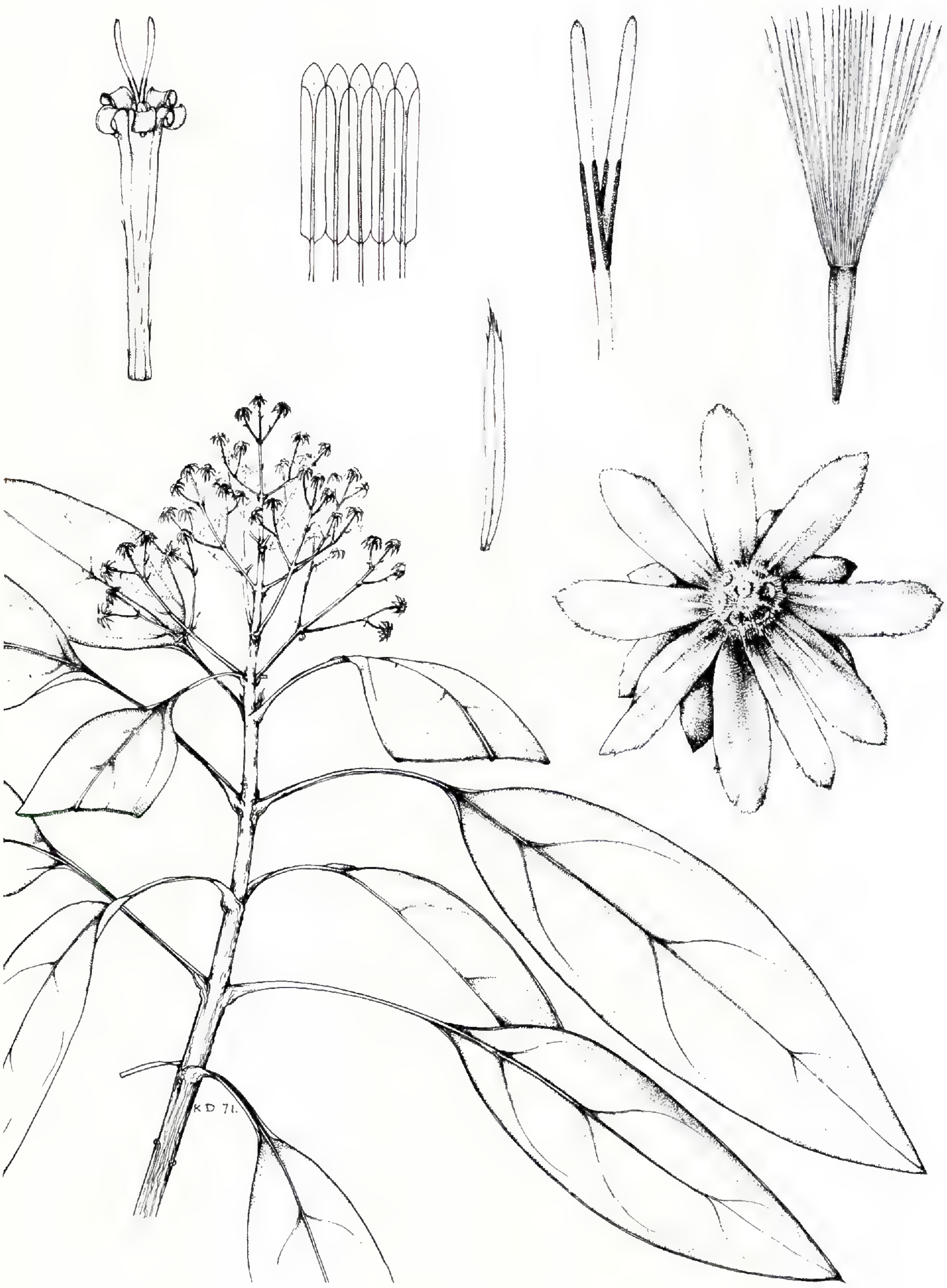

FIG. 11. *Eupatorium altiscandens* (*McVaugh 23092*, type). Leafy branch with over-mature inflorescence, X ½; receptacle and surrounding phyllaries of over-mature head, ca X 7.5; corolla, pale, and achene, X 5; anthers and style-tips, X 10.

laribus ca 1 mm longis, pilosis; antherae 1.5 mm longae, basi obtusae, appendicibus acutis 0.4 mm longis; styli ramuli filiformes exserti 4–5 mm; achaenia 3–4 mm longa, nigrescentia, sub-5-angulata, columnari-clavata, angulis minute strigosis, lateribus copiose globulis albidis ca 0.1 mm diametro conspersis; pappus albus biseriatus, setis interioribus ca 30 barbellatis, crassiusculis, apice paullo dilatatis, corollam sub-aequantibus, exterioribus paucis (ca 10), 0.5–1.5 mm longis; receptaculum glabrum.

JALISCO: Sierra de Cuale, SW of Talpa de Allende, barrancas in fir zone, elev. 1800–2250 m, 19–21 Nov 1952, *McVaugh 14392* (MICH, type); Talpa de Allende, above the headwaters of the Río Mascota, ca 20 km S of El Rincón, barranca in fir forest, 2000–2250 m, 29 Nov 1960, *McVaugh 21549*; Tecalitlán, Sierra del Halo, in pine forest, 1700–1800 m, 1 Dec 1959, *McVaugh & Koelz 1289*. Otherwise unknown.

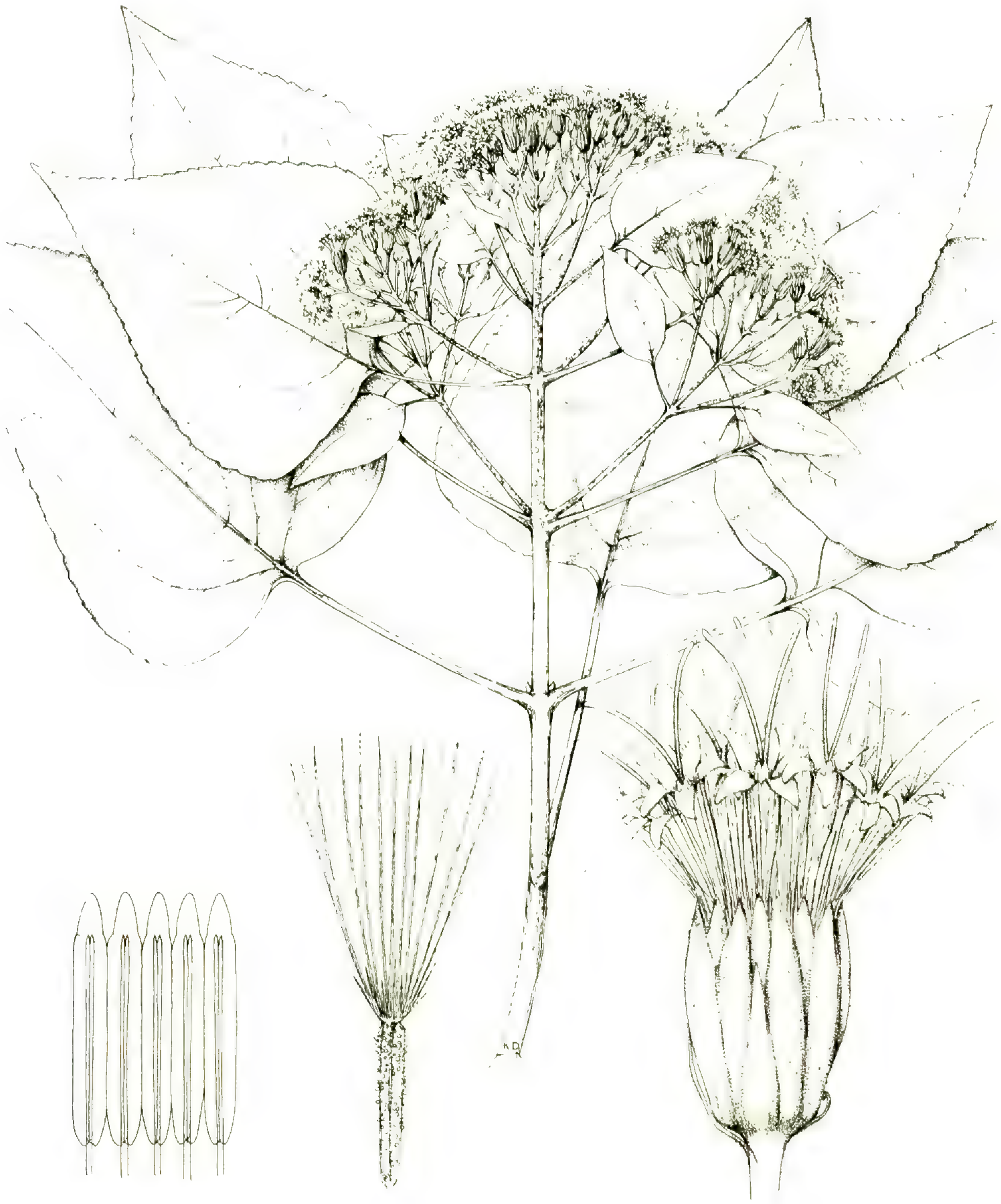

FIG. 12. *Eupatorium ceriferum* (*McVaugh 14392*, type). Flowering branch, X ½; flowering head, and achene, X 5; anthers, X 15.

This is one of a small group of shrubs and trees that have mostly been referred to *Eupatorium mairetianum* DC. They are widespread and abundant in pine and fir forests throughout the mountains of southern Mexico, flowering mostly from December to April. Members of the group may be recognized easily by the arborescent habit, the opposite and mostly palmately nerved leaves, large compound inflorescences of relatively large (mostly 1–1.5 cm long) but few-flowered heads (flowers mostly 12–30, rarely 50–70), and biseriate pappus consisting of an inner series of long bristles and an outer series of few–15 bristles 0.5–1.5 mm long. In Nueva Galicia there appear to be four species of the *mairetianum* group. These, and one somewhat similar species in which the pappus is also biseriate, may be contrasted as follows:

1. Peduncles and phyllaries evidently stipitate-glandular.
   2. Stems, petioles, and veins of the lower leaf-surface coarsely tomentose with brownish hairs up to 2 mm long; petioles 4–9 cm long; flowers about 30; phyllaries 15–20; achenes strigose. *E. chiapense* Rob.
   2. Branchlets and young herbage thinly arachnoid-tomentose, the leaves densely arachnoid in the vein-axils; petioles 2–3.5 cm long; flowers (30–) 45–70 in a head; achenes evidently stipitate-glandular and also bristly. [*E. chapalense* S. Wats.] *E. lasioneuron* Hook. & Arn.
1. Peduncles and phyllaries nearly glabrous to glutinous or arachnoid-tomentose, or both, the stipitate glands if present inconspicuous.
   3. Involucre 5–6 (–7) mm long; flowers 20–27 in a head.
      4. Flowers pink or purplish; inflorescence elongate, forming an ovoid or subcylindric thyrse; inflorescence and phyllaries green, very thinly tomentose; achenes glutinous, somewhat resinous-dotted. *E. cylindricum* McVaugh.
      4. Flowers white; inflorescence round-topped, broader than long; inflorescence and phyllaries whitened by the arachnoid tomentum; achenes copiously sprinkled with whitish waxy particles 0.1 in diameter. *E. ceriferum* McVaugh.
   3. Involucre (7–) 8–12 mm long; flowers white (the phyllaries often purplish); achenes glutinous or minutely resinous-dotted, or bristly in addition.
      5. Flowers (30–) 45–70 in a head; achenes usually both glandular and bristly; inflorescence and phyllaries usually somewhat whitened by the thin tomentum. [*E. chapalense*]. *E. lasioneuron.*
      5. Flowers (11–) 15–32 in a head; achenes usually with sessile glands but few or no bristles in addition.
         6. Inflorescence and phyllaries strongly glutinous, nearly glabrous; branchlets reddish; flowers 25–32 in a head. Jalisco and Durango. *E. mairetianum* DC., forma *elucens* McVaugh.
         6. Inflorescence and phyllaries moderately or indistinctly glutinous, usually somewhat whitened by the thin tomentum; flowers (11–) 15–22 (–25?); Jalisco to Hidalgo and México. *E. mairetianum* DC., forma *mairetianum.*

Eupatorium cylindricum McVaugh, sp. nov.

Frutex procerus, vel arborescens, caulibus 3–5-metralibus, ramulis foliisque juvenilibus paullo arachnoideo-tomentosis glutinosisque, pedunculis phyllariisque pauciglandulosis; folia mox glabrescentia, pilis secum nervum medium et subtus in venarum majorum axillis persistentibus; foliorum laminae late ovatae vel deltoideae, triplinerves vel venis pinnatis, 6–11 cm longae, 5–9 cm latae, saepe tam latae quam longae, vel sesquilongiores quam latiores, apice subobtusae, basi late truncato-subcordatae vel rotundatae, marginibus quoque latere dentibus late triangularibus 30–40 dentatis, prope basin integris et in petiolum 3–5 cm longum cuneatim decurrentibus; folia inflorescentiae ramulorum integra vel subintegra, ovata, 1–3.5 cm longa; inflorescentia thyrsiformis, cylindrica vel anguste ovoidea, (10–) 30–50 cm longa, paucifoliata, ramis ascendentibus 5–15 cm longis, 2–3-plo ramosis; capitula plurima, 21–27-flora, sub anthesi subrosea vel purpurascentia, pedunculis 4–10 mm longis; involucrum 5–6 mm longum, campanulatum, basi paullo incrassatum, 2–3-seriatum; phyllaria 20–25 (–30), interiora subaequalia ca 15, elliptico-lanceolata, acuta, 0.8–1 mm lata, exteriora vix breviora, extima angustiora; corolla alba vel pallide subrosea, 5–6 mm longa, anguste tubuloso-campanulata, lobis 0.8 mm longis pilosis; antherae 1.3–1.5 mm

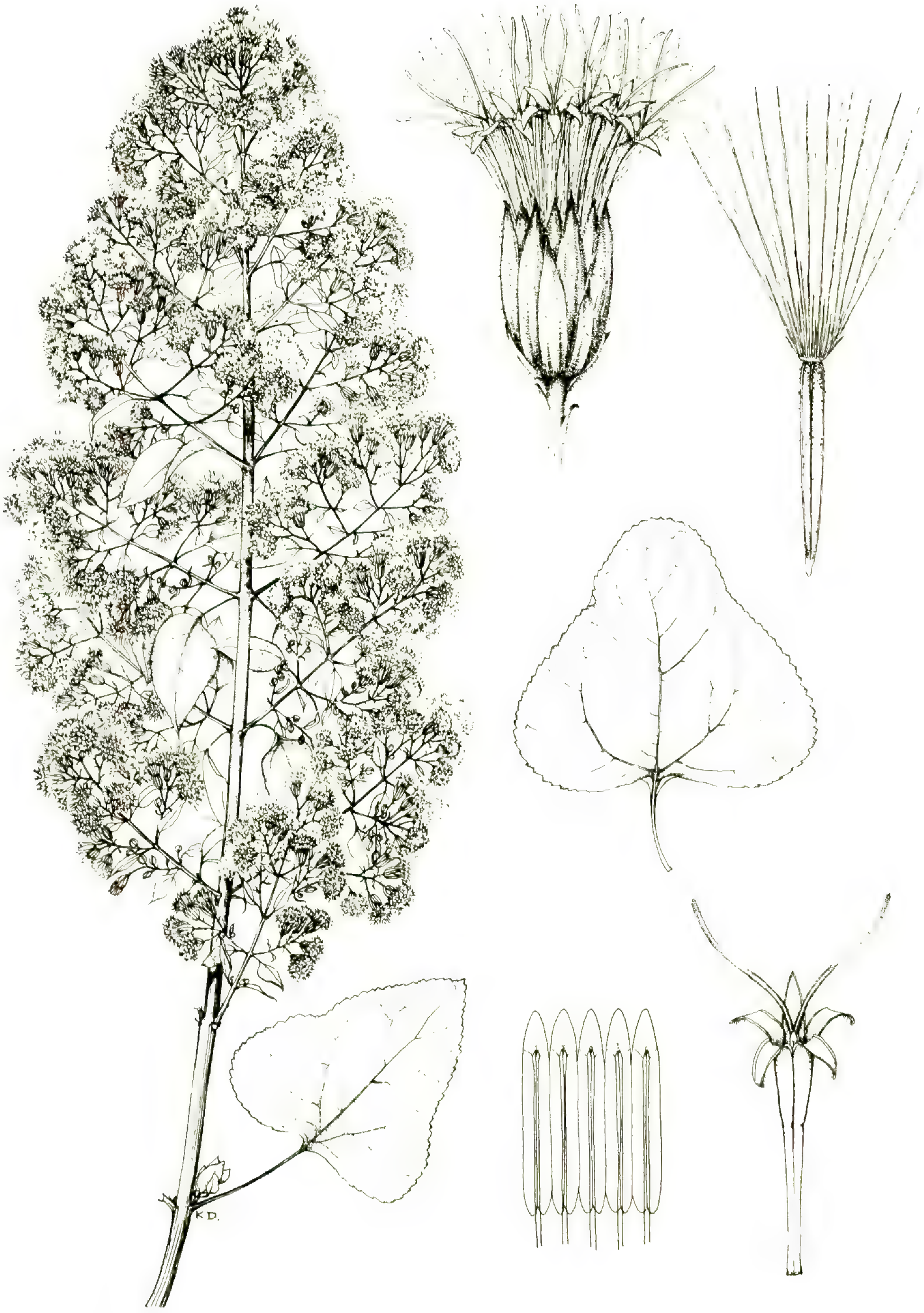

FIG. 13. *Eupatorium cylindricum.* Flowering branch, X ½ (*McVaugh 11799*). Detached leaf, X ½; flowering head, | X 5; achene and corolla, X 7.5; anthers, X 15 (all from *McVaugh 23475,* type).

longae, basi obtusae, appendicibus 0.2–0.3 mm longis; styli ramuli filiformes, exserti 4 mm; achaenia 3.8–4.5 mm longa, nigrescentia, 5-angulata, clavato-columnaria, substipitata, globulis resinosis instructa, et prope apicem etiam stipitato-glandulosa; pappus subroseus, biseriatus setis interioribus ca 30, barbellatis, crassiusculis, apice paullo dilatatis, corollam subaequantibus, exterioribus paucis (ca 10), 0.5–1.5 mm longis; receptaculum glabrum.

JALISCO: Mountain stream-valley in pine-oak forest zone, ca 20 km SE of Talpa de Allende, 8–10 km S of El Rincón, elev. 1600 m, 2–3 Apr 1965, *McVaugh 23475* (MICH, type); 20–22 km S of Talpa, pine forest near headwaters of Río de Talpa, 1200–1450 m, 28–30 Mar 1965, *McVaugh 23330;* Nevado de Colima, SE foothills, 1600 m, 5 Apr 1951, *McVaugh 11799*; Nevado de Colima, NW slopes in pine forest above Jazmín, 2250 m, 31 Mar 1949, *McVaugh 10144;* above San Juan Cozalá, in oak forest, 1900 m, 29 Mar 1964, *L. M. Villarreal de Puga.*

MEXICO: Near Valle de Bravo, 22 Feb 1943, *Dodds 6.*

This species, rather easily recognized in the field by its pinkish flowers and pink pappus, and by the more or less cylindriform inflorescence which often terminates a leafless or nearly leafless branch, seems to be most abundant in relatively dry open habitats, rocky ridges and slopes in pine or oak forest at middle elevations (ca 1400–2200 m). *E. ceriferum* occurs in somewhat more humid habitats at similar elevations, in fir forest or in barrancas with more mesophytic species of *Quercus, Ostrya, Cornus* and other broad-leaved trees, or sometimes in pine forest. *E. mairetianum,* with which both the above have been confused, is primarily a plant of relatively humid forests at somewhat higher elevations, from 2000 to 3000 m.

Eupatorium dolichobasis McVaugh, sp. nov.

Herba perennis ramosa lignosa, interdum suffruticosa 1–1.5-metralis, foliis fere glabris, ramulis pedunculisque antrorse pilis minutis, pallidis subglandulosisque pubescentibus; folia opposita, membranacea, ovata vel rhomboideo-ovata, caulinia 8–15 cm longa, 4–7.5 cm lata (ramulorum florescentium simillima sed minora), attenuato-acuminata (apicibus angustis, integris 1–1.3 cm longis, obtusis vel acutis), basi rotundata vel subtruncata, triplinervia (nervis principalibus supra laminae basin 5–15 mm oriundis), marginibus utroque latere dentibus 15–25 ad 3 mm altis grosse serratis, basi integris, in petiolos tenues 2.5–5 cm longos cuneatim et saepe inaequaliter decurrentibus; inflorescentia subcorymbosa composita, ramis saepe 20–25 cm longis, corymbis secondariis confertis 6–10 cm longis latisque; capitula plurima 6–7 mm longa, 25–29-flora, pedunculis tenuibus linearibracteatis 3–8 mm longis; involucrum ca 3.5 mm longum campanulatum, biseriatum, basi abrupte contractum; phyllaria 12–14 subaequalia, lineari-oblonga vel -lanceolata (vel extimorum 1–3 breviora et angustiora), basibus puberulentibus incrassata bicostataque, apicibus membranaceis, ciliatis, obtusis vel subacutis glabra; corolla alba, 3–3.3 mm longa, tubo lineari quam fauce ampliata longiore vel eam subaequanti, lobis pilosis triangularibus 0.5–0.7 mm longis; antherae basi subauriculatae, appendicibus ovatis inclusis 1 mm longis vel paullo longioribus; styli ramuli 1–1.5 mm exserti; achaenia 1.5–1.8 mm longa, nigrescentia, clavato-columnaria, 5-angulata, ad basin pallidam callosam angustata, distaliter sub pappi basin coroniformem contracta; pappi setae fragilissimae ca 20, barbellatae, 3–3.5 mm longae; receptaculum glabrum.

JALISCO: Mountain stream-valley ca 20–25 km SE of Talpa de Allende, 12–13 km S of El Rincón, in barranca-forest with *Abies, Podocarpus, Quercus,* and other broad-leaved trees, elev. 1700–1900 m, 3–4 Apr 1965, *McVaugh 23476* (MICH, type); stream-valley ca 25 km SE of Autlán, above El Chante, in barranca-forest, elev. 2400–2600 m, 13 Apr 1949, *McVaugh 10270.*

Similar plants, with ovate leaves cuneate at base, and triplinerved from well above the base, are known from northern Michoacán (*McVaugh 9982*). In these the heads are larger than in the specimens from Jalisco, and the phyllaries more pointed.

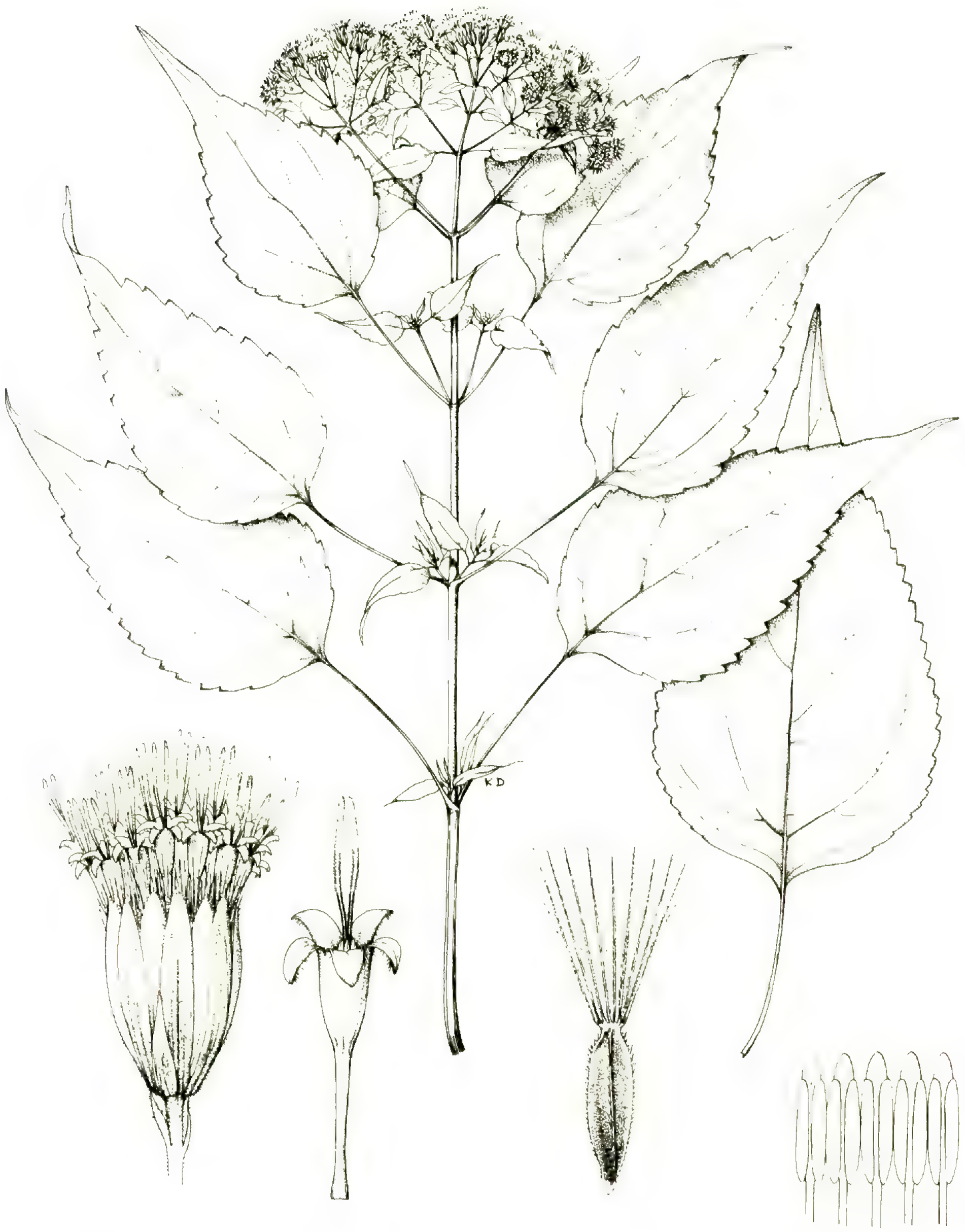

FIG. 14. *Eupatorium dolichobasis* (*McVaugh 23476*, type). Flowering branch, X ½; flowering head, ca X 6.5; corolla and achene, X 10; anthers, X 15.

This species is superficially similar to *Eupatorium conspicuum* Kunth & Bouché, as interpreted by Robinson in the *Trees and Shrubs of Mexico*, but in *E. conspicuum* the involucre is 4–6 mm long, the heads are about 40-flowered, and the leaves tend to be coarsely serrate even on the decurrent base.

Eupatorium geminatum McVaugh, sp. nov.

Herba perennis e caudice brevi, caulibus florentibus verisimiliter annuis 1.5-metralibus, diametro ad 5 mm, supra medium tenuiramosis; planta tota fere glabra, caule ramulisque rare pilis appressis multicellularibus instructis, foliorum venis margini-

busque paucipilosis; globuli resinosi pauci, inconspicui, vel nulli; foliorum paria ca 9–12, folia membranacea, opposita, sessilia, tripli- vel 5-plinervia, 5–12 cm longa, 2–5 cm lata, sensim acuminata, ad basin rotundata, marginibus basi excepta crenato-serratis, inter se linea transnodali connexis; rami 10–25 cm longi, inflorescentiam densam vix formantes, sed capitulis in quoque ramo 10–25 in corymbis secondariis irregularibus parvibracteatis laxe aggregatis, pedunculis 3–7 cm longis; involucrum

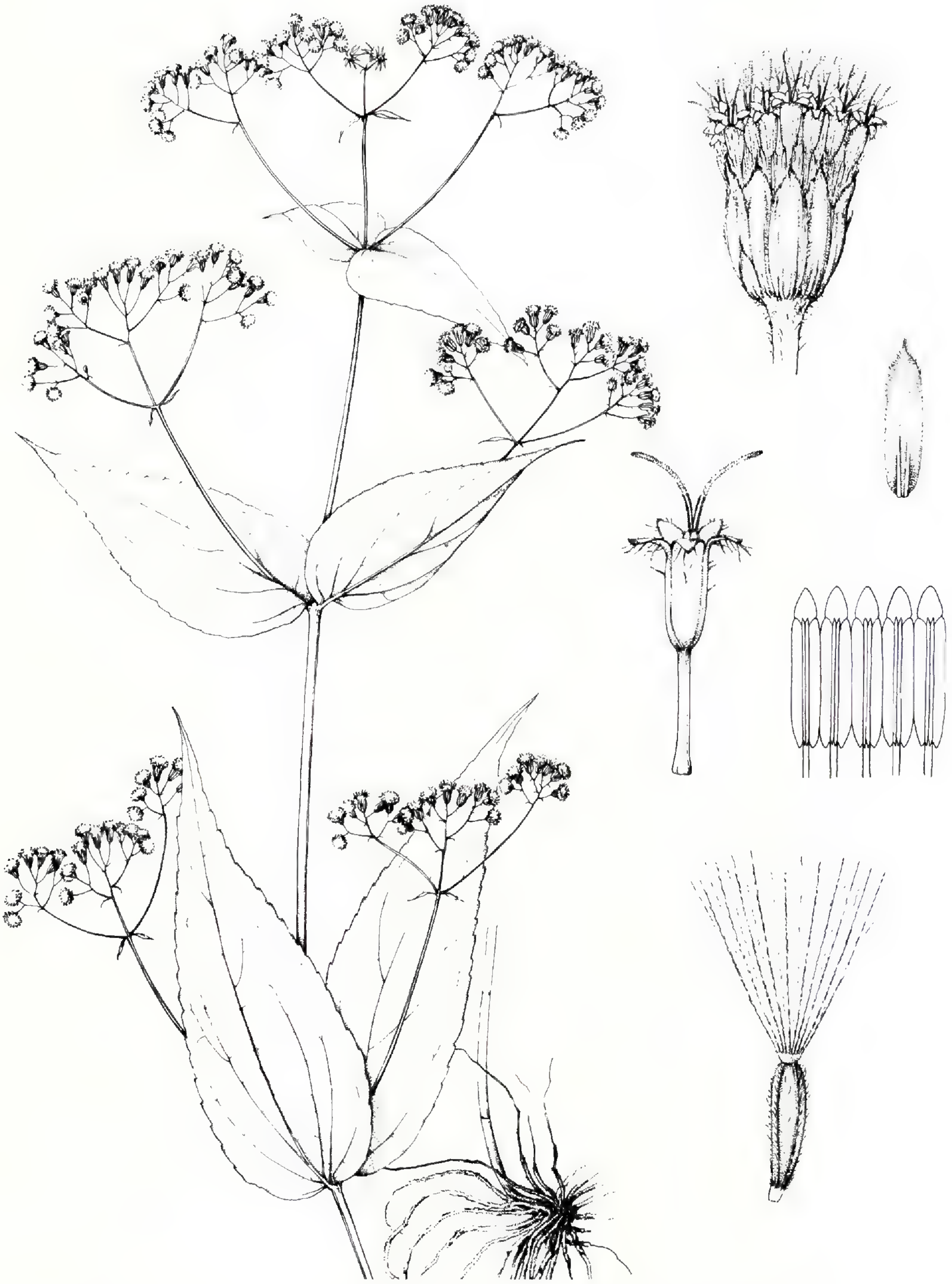

FIG. 15. *Eupatorium geminatum* (*McVaugh 24807*, type). Flowering branch, X ½; flowering head and detached phyllary, ca X 5; corolla and achene, X 10; anthers, X 20.

campanulatum 4–6 mm longum, ca 2-seriatum; phyllaria 12–15, ex apice pedunculi dilatato oriunda, subaequalia, lineari-lanceolata, 0.5–0.8 mm lata, basi bicostata incrassataque, apicibus tenuibus attenuatis, marginibus hyalinis; capitula sub anthesi 5–7 mm longa, 25–35-flora, corolla alba, 3–3.5 mm longa, tubo basi dilatato-campanulato, supra in faucem aequilongem abrupte expanso, lobis pilosis triangularibus 0.5 mm longis; antherae 0.6–0.7 mm longae, basi subauriculatae, appendicibus ovatis 0.2 mm longis; styli ramuli clavato-filiformes, 1.5–2 mm exserti; achaenia oblique fusiformia, ca 1.5–1.8 mm longa, nigrescentia, 5-angulata, lateribus angulisque strigosa, subaequaliter ad basin callosam et sub pappi basin coroniformem contracta; pappi setae albae ca 20, barbellatae, 3–4 mm longae, mox deciduae; receptaculum glabrum.

JALISCO: Tecalitlán, Sierra del Halo, in pine forest, elev. 2000–2200 m, 28–30 Nov 1959, *McVaugh & Koelz 1164.*

MICHOACAN: Forested slopes in deep shade, in calcareous soils, 3–6 km SE of Aserradero Dos Aguas, nearly W of Aguililla, elev. 2000–2100 m, 25 Nov 1970, *McVaugh 24689*; NW foothills of Cerro Tancítaro, 13–14 km S of Peribán de Ramos, in barrancas, elev. 1650–1700 m, 29 Nov 1970, *McVaugh 24807* (MICH, type).

Among the perennial, herbaceous, opposite-leaved, white-flowered species of *Eupatorium* this one seems relatively distinct. Among such species in Nueva Galicia it is the only one with subequal phyllaries, 20 or more flowers in the head, relatively few and fragile pappus-bristles, and thin sessile leaves. The pappus-bristles in this and a few other species of *Eupatorium* are almost as easily detached as those of our species of *Piptothrix*, but the latter are shrubs with even fewer pappus-bristles (commonly 10–15) and fewer than 20 flowers in a head.

Eupatorium halbertianum McVaugh, sp. nov.

Herba perennis 2-metralis, inflorescentia excepta simplex, caulibus basi ad 1 cm diametro, sub nodis compressis ad 1 cm latis, longitudinaliter purpureo-maculatis, supra nodos majores grosse pilosis; ramuli inflorescentiaque crebre breveque stipitato-glandulosi; folia membranacea, supra scabridula, praecipue in venis prope basin in superficiebus ambabus pilosa et stipitato-glandulosa, vix vel haud globulifera, longipetiolata, triangulari-hastata, 3 (–5)-nervia, 21–24 cm longa, 23–27 cm lata, gradatim acuminata, apice attenuato 1.5–2.5 cm longo, apicibus angulorum lateralium similibus sed brevioribus; folii lamina basi cordata, sinu aperto, non profundo, marginibus lateralibus basalibusque grosse dentibus irregularibus rotundis vel ovatis onustis; petiolus (8–) 14–18 cm longus, purpureus, distaliter venis majoribus divergentibus dilatatus, et laminae basi in aream triangularem haud marginatam transiens; venulae pellucido-reticulatae, in siccitate nec elevatae nec conspicuae; inflorescentia laxa, interrupta, paniculiformis ad 50 cm longa, ramulis lateralibus ascendentibus 20–30 cm longis, capitulis plurimis, in quaque panicula secondaria 10–25, pedunculis subclavatis 2–7 mm longis; capitula 8–9 mm longa, 10–15-flora; involucrum 5–6 mm longum, campanulatum, ca 2-seriatum, basi carnosulum; phyllaria ca 11–12, subaequalia vel exteriora 3–4 breviora, cetera 4–5 mm longa, ad 1 mm lata, lineari-lanceolata, acuta vel attenuata, basi incrassata glandulosaque, marginibus tenuibus ciliatis; corolla e roseo alba, glabra, 5–6 mm longa, anguste tubuloso-infundibuliformis, lobis ovato-triangularibus 0.7–0.8 mm longis; antherae 1.2 mm longae, basi auriculatae, appendicibus anguste ovatis 0.4 mm longis; styli ramuli filiformes, 3–4 mm longi; achaenia 2.5–3 mm longa, nigrescentia, clavato-columnaria, ca 5-angulata, lateribus angulisque strigosis; pappi setae albae 3–4 mm longae, 25–30, barbellatae, inter se distantes; receptaculum glabrum.

JALISCO: Near Santa Mónica (probable Lat. ca 20° N, Long. ca 104° 30′ W.), steep mountainsides in fir forest, elev. 1950–2050 m, 12–13 Nov 1952, *McVaugh 14049* (MICH, type). Known only from the type collection.

The leaves of this species recall in shape those of *E. deltoideum* Jacq., a plant of the eastern highlands of the Sierra Volcánica Transversal, ranging westward to Guanajuato. In *E. deltoideum* the leaves are almost conventionally sagittate, with two straight-sided deltoid lobes extending backward toward the petiole. In *E. halbertianum*

the lateral lobes extend at right angles to the long axis of the leaf, and the basal margins are convex and the blade often cordate. The heads of *E. deltoideum* are 35–40-flowered, the phyllaries are about twice as many as in *E. halbertianum,* and the flowers, achenes, and involucres are larger in most respects than in that species.

Eupatorium mairetianum DC. in DC. Prodr. 5: 167. 1836, forma **elucens** McVaugh, f. nov.

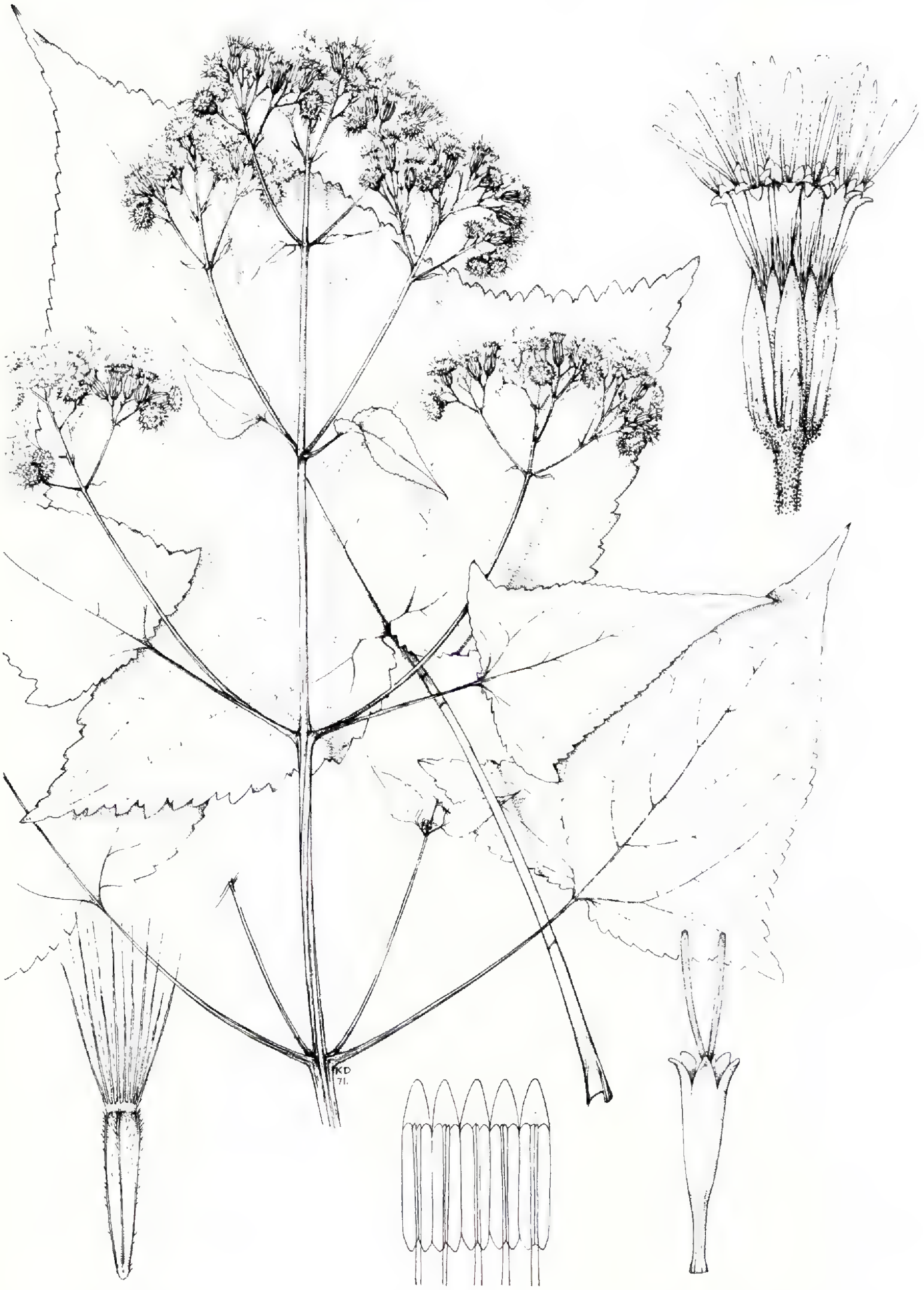

FIG. 16. *Eupatorium halbertianum* (*McVaugh 14049,* type). Flowering branch, X ½; flowering head and corolla, X 5; achene, X 7.5; anthers, X 15.

1. Inflorescentia et phyllaria valde glutinosa, fere glabra; ramuli purpureo-rubri; capitula 25–32-flora. *E. m.* forma *elucens.*

1. Inflorescentia et phyllaria modice vel vix glutinosa, plerumque tomento sparso paullo dealbata; ramuli non semper rubri; capitula plerumque 15–22-flora, floribus interdum 11 vel usque ad 25. *E. m.* forma *mairetianum.*

The following specimens of f. *elucens* have been examined:

JALISCO: Nevado de Colima, NW slopes above El Izote, barranca in fir zone, elev. 2600–2800 m, 26 Mar 1949, *McVaugh 10052* (MICH, type); Nevado de Colima, SE slopes, in fir forest, elev. 2850 m, 2 Apr 1951, *McVaugh 11710.*

DURANGO: Mountains between Durango and Mazatlán, between El Salto and the border of Sinaloa, elev. 1950–2400 m, *McVaugh 11557, 23602.*

SINALOA: Near the Durango border, road from Mazatlán to Durango, elev. 1950 m, 31 Jan 1962, *Breedlove 1722.*

What I am calling *Eupatorium mairetianum* (in the restricted sense) is a widespread species with somewhat larger heads than those of the closely related *E. ceriferum* and *E. cylindricum*; see the key under *E. ceriferum.* The nomenclatural type (*Mairet!* s.n. in G-DC) represents a nearly glabrous but only slightly viscid plant, with narrow phyllaries and a relatively diffuse inflorescence. Similar plants are found commonly in the Valley of Mexico and from as far east as Mt. Ixtaccíhuatl, and occur, although apparently less commonly, as far west as Cerro Tancítaro, C. Patamban, and the Nevado de Colima. In Nueva Galicia, however, the species is more often represented by plants in which the herbage is even less viscid and somewhat more densely arachnoid-tomentose, the phyllaries are a little less narrowly pointed, the inflorescence a little more compact, and the flowers mostly 15–22 in a head. The taxonomy of this and related species, in the whole area from north-western Mexico to Central America, is in need of further study. The newly described f. *elucens* apparently represents one extreme, perhaps intermediate between *E. mairetianum* and *E. lasioneuron* Hook. & Arn. In the latter the number of flowers in a head varies from about 30 to almost 100, and the herbage is somewhat stipitate-glandular. In Nueva Galicia it is not always possible to separate *E. lasioneuron* and *E. mairetianum* satisfactorily, but in general plants with many-flowered heads tend to be somewhat stipitate-glandular.

Eupatorium misellum McVaugh, sp. nov.

Frutex debilis 50–80 cm altus, ramis rare pubescentibus, foliis (venis majoribus exceptis) mox glabrescentibus; folia subtus crebre resinoso-globulifera, opposita, membranacea, triplinervia, lanceolata, 7–12 cm longa, 1–2 cm lata, 6–10-plo longiora quam latiora, ad apicem acutum angustissimum attenuata, ad basin angustam subaequaliter producta, marginibus utroque latere dentibus 4–7 remotis serrulatis, ad basin in petiolos 3–8 mm longos sensim transientibus; capitula pauca, plus quam 1 cm longa, ca 45-flora, in fasciculis 1–5-cephalis ramos superiores divaricatos 5–12 cm longos terminantia, pedunculis 9–17 mm longis; involucrum 7–9 mm longum, medio 3.5–4 mm crassum, campanulatum vel ad apicem angustatum, 5–6-seriatum; phyllaria ca 50–60 valde imbricata appressa, exteriora gradatim breviora, intima 5–8 longiora angusta, sublinearia vel oblanceolata 1 mm lata, straminea, cetera oblonga 1.5–1.8 mm lata, late obtusa, marginibus latis albis membranaceis fimbriato-ciliatis, costa bilineata viridi fere ad apicem extensa; corolla verisimiliter caesia, 5 mm longa, glabra, angustissima, tubo cylindrico quam fauce longiore et in eam sensim ampliato, lobis triangularibus 0.5 mm longis; antherae 1.7 mm longae, basi obtusae, appendicibus ovatis 0.3 mm longis; styli ramuli filiformes, 3–4 mm exserti, caesii, vividi; achaenia 4–4.2 mm longa, nigrescentia, clavata, substipitata, 3–5-angulata, angulis prominentibus scabrellis; pappi setae ca 40, grossae, barbellatae, 4–5 mm longae, albidae; receptaculum glabrum, breve conicum, 1.5 mm latum, 1 mm altum.

JALISCO: Talpa de Allende, precipitous mountainsides on the seaward-facing slopes above La Cuesta, on rock ledges in tropical subdeciduous forest, elev. 800–1400 m, 15–16 Oct 1960, *McVaugh 20254* (MICH, type). Known only from the type-collection.

FIG. 17. *Eupatorium misellum* (*McVaugh 20254*, type). Flowering branch, X ½; flowering head, ca X 2.5; corolla and achene, ca X 5; anthers, X 12.5.

Apparently referable to the Sect. *Cylindrocephala* as defined by DeCandolle, Robinson, and others, because of the numerous closely imbricated phyllaries in 5–6 series, but not like any other Mexican species of that alliance.

Eupatorium trinionum McVaugh, sp. nov.

Herba perennis 1–2-metralis, e caudice brevi lignoso, caulibus erectis solitariis vel paucis, duris, basi ad 5 mm diametro, inflorescentia excepta simplicibus, atropurpureis vel purpureo-maculatis, tota longitudine pilis grossis flaccidis multicellularibus pubescentibus, pilis in inflorescentia numerosissimis et cum globulis resinosis numerosis et interdum glandulis stipitatis immixtis; folia opposita, subtus crebre resinoso-globulifera et venis praecipue pilosa, supra et marginibus scabridula; laminae 5–11 cm longae late ovato-cordatae vel -deltoideae, saepe tam latae quam longae vel ad sesqui-longiores quam latiores, ca sesquilongiores quam petiolos, acutae vel foliorum inferiorum obtusae, basi late truncato-cordatae, 3(–5)-nervatae, marginibus (sinu basali excepto) utroque latere dentibus 30 vel ultra grossis obtusisque crassimarginatis instructis; petioli 2–6 cm longi; inflorescentia laxa subcorymbosa composita, ad 30 cm longa lataque, ramis divaricatis per folia parva subtentis; capitula ca 1–1.5 cm longa, 23–35-flora, subumbellatim aggregata, pedunculis 5–10 mm longis; involucrum 5.5–7.5 mm longum, campanulatum, basi carnosulum, ca 2-seriatum; phyllaria 12–18, subaequalia, pubescentia et globulifera, lineari-lanceolata, 0.6–1 mm lata, intima saltem apicibus tenuibus attenuatis, exteriora interdum breviora et tantum acuta, extima 1–3 plerumque quam cetera multo breviora angustioraque; corolla glabra, subrosea vel pallide purpureo-rosea, 5.5–6.5 mm longa, supra tubum brevem anguste tubuloso-infundibuliformis, lobis triangulari-ovatis 1 mm longis vel brevioribus; antherae 1.4–2 mm longae, quam corolla pallidiores, basi auriculatae, appendicibus ovatis 0.3–0.4 mm longis; styli ramuli filiformes, 3.5–6.5 mm exserti; achaenia 2.3–3 mm longa, nigrescentia, clavato-columnaria, 5-angulata, sub pappi basin coroniformen brunneam contracta, copiose breve hispidula; pappi setae plerumque purpurascentes 20–25, 3–5 mm longae, barbellatae, fragiles, vix contiguae; receptaculum glabrum.

ZACATECAS: Puerto de la Paja, 20 km WSW of Valparaíso, grassland with scattered oaks, elev. 2250 m, 30 Oct 1963, *Rzedowski 17535.*

AGUASCALIENTES: Road to Calvillo, 33–34 km W of Aguascalientes, rocky hills among small oaks, elev. 2100 m, 3 Nov 1959, *McVaugh & Koelz 146.*

JALISCO: Near Mezquitic, 8–10 km SE of El Mortero, open oak woodland, elev. 2450 m, 5 Nov 1963, *Feddema 2456* (MICH, type); Volcán Tequila, elev. ca 2300 m, 24 Oct 1970, *Webster & Breckon 15875.*

In many ways this species resembles *Eupatorium rubricaule* H.B.K., but in the latter the involucre is 3.5–4 mm long, the phyllaries glabrous or nearly so, and herbage essentially without glandular dots, the flowers and achenes smaller than in *E. trinionum,* and the pappus shorter in relation to the corolla. *E. rubricaule* is one of the earliest species of *Eupatorium* to flower, beginning early in September in Nueva Galicia, whereas *E. trinionum* as far as known flowers in October and November. *E. rubricaule* is a plant of relatively humid woodlands and barrancas, often at elevations of 2500 m or more, and ranging from Jalisco eastward, but *E. trinionum* appears to be adapted to relatively dry grasslands and woodland openings in the northern part of Nueva Galicia.

Hofmeisteria urenifolia (Hook. & Arn.) Walp., var. **mexiae** (Rob.) McVaugh, comb. nov. *Fleischmannia urenifolia* var. *mexiae* Rob. Contr. Gray Herb. II. 96: 18. 1931.

This is a distinctive plant, at once recognized by the matted-tomentose or hirsute stems and petioles, covered with delicate hairs up to 3 mm long; the leaves are undivided, ovate, obtuse, truncate or cordate at base, the margins incised-dentate with 6–12 lobelike teeth, each large tooth bearing 2–7 small acute serrations.

In *H. urenifolia* var. *urenifolia* the leaves are pinnately divided to the midvein, or if occasionally merely lobed or dentate, the blades rounded at base, with coarse and nearly simple teeth; the stems are glabrous or glandular, or thinly hirsute.

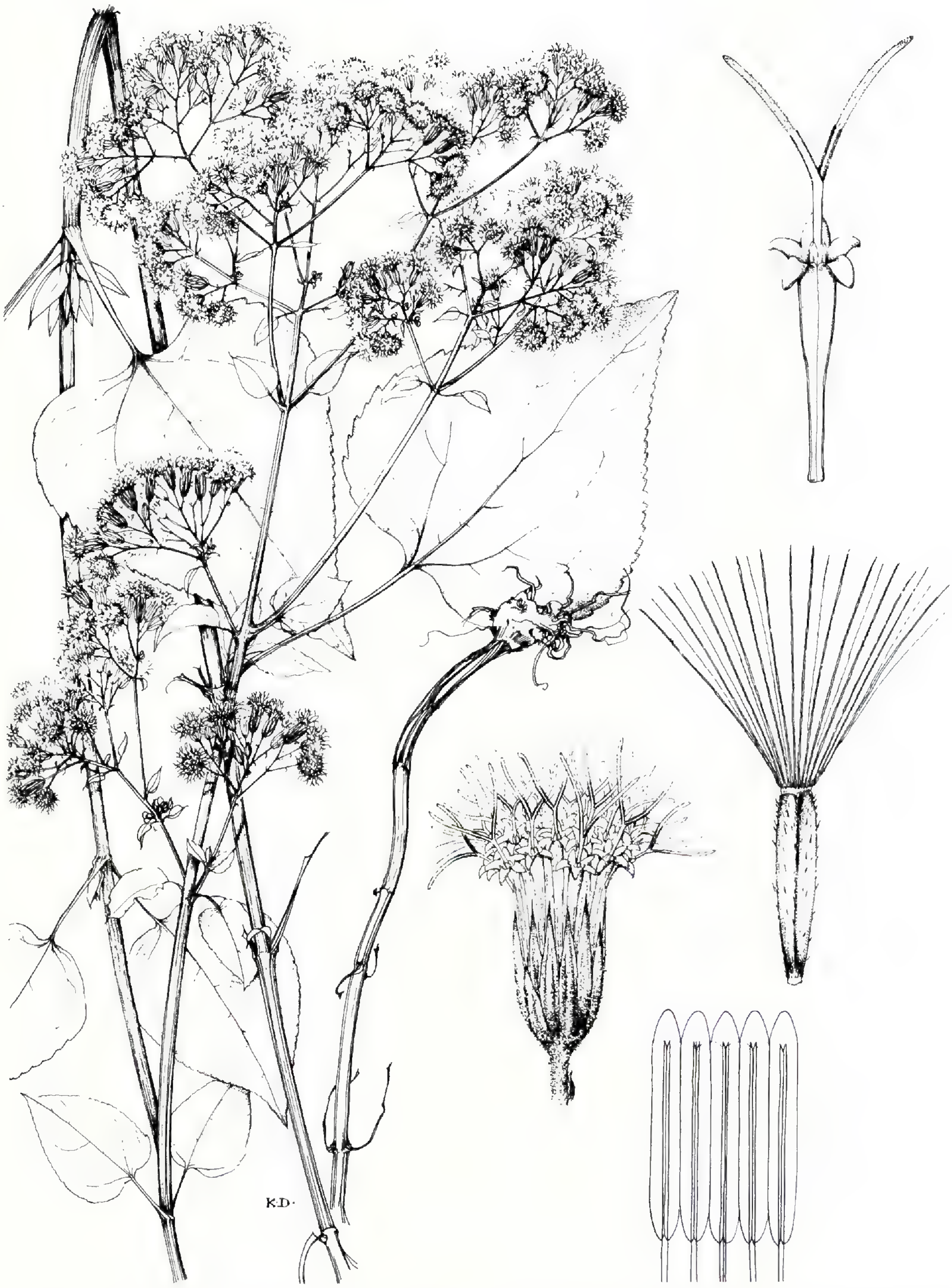

FIG. 18. *Eupatorium trinionum* (*Feddema 2456,* type). Flowering plant, X ½; flowering head, ca X 2.5; corolla, X 5; achene, X 10; anthers, X 15.

Stevia myricoides McVaugh, sp. nov.

Frutex pauciramosus 1.5–2-metralis, ramis foliisque oppositis; ramuli dense vel rare hispidi, pilis attenuatis brunnescentibus vel pallidis, erectis sed antrorse curvatis; ramulorum minimorum, pedunculorum phyllariorumque pili interdum conspersi, plerumque pallidiores, tenuiores, et cum globulis resinosis immixti; folia matura carnosula, omnino glabra vel plerumque subtus secus costam saltem pilis longis obsita, supra secus costam saltem hispidula, utrinque obscure resinoso-globulifera; folia

pennivenia vel obscure triplinervia, elliptica, lanceolata vel oblanceolata, basi petioliformi inclusa 6–13 cm longa, 1–3 cm lata, 3–6 (–10)-plo longiora quam latiora, rami superiora plerumque acuta vel ad apicem ultimum obtusiusculum attenuata, rami inferiora saepe oblanceolata obtusaque; laminae utroque latere dentibus paucis vel usque ad 10 distantibus et plerumque obscuris crenato-serratae, basi productae, acutae vel cuneatae, marginibus decurrentibus fere ad basin petioli extensis sed ibi angustissimis, petiolo ut videtur 1 cm longo, basi dilatato sed cum basi petioli oppositi haud contiguo; venulae foliorum siccorum supra minute impressae, subtus paullo elevatae; inflorescentia composita, convexa, corymbiformis, usque ad 10 cm longa lataque, capitula subsessilia in apicibus ramulorum glomerulata conspersa ca 1 cm longa; phyllaria pallide viridia, dorsaliter copiose pubescentia, 5–6.5 mm longa, nunc omnino linearia (apice obtusa vel rotundata), nunc acuta, attenuata; corolla alba, 5–6 mm longa, tota longitudine pilosa, tubo angusto quam fauce subcylindrica multo breviore, lobis latis 1–1.5 mm longis; achaenia homomorpha, exaristata 4–6 mm longa, clavato-columnaria, praecipue versus apicem hispidula; pappus ex squamis albis opacis scariosis, basi connatis, truncatis erosisve 0.4–0.6 mm longis compositus.

NAYARIT: Ravines in pine forest between Jalcocotán and Tepic, elev. 1050–1100 m, 22 Apr 1951, *McVaugh 12126.*

JALISCO: San Sebastián, E of Arroyo Sta. Gertrudis, elev. 1500 m, 17 Jan 1927, *Mexia 1501;* 20–22 km S of Talpa de Allende, in pine forest, elev. 1200–1450 m, 28–30 Mar 1965, *McVaugh 23299* (MICH, type); same locality, sterile 23–25 Nov 1960, *McVaugh 21359*; 20–25 km SE of Talpa, 12–13 km S of El Rincón, humid forest of *Abies, Podocarpus* and broad-leaved trees, 1700–1900 m, 3–4 Apr 1965, *McVaugh 23461;* 30–35 km SE of Autlán, Sierra de Manantlán, deciduous forest with *Podocarpus* and broad-leaved trees, 1500–1900 m, 22–23 Mar 1965, *McVaugh 23181.*

Among the species of *Stevia* that are shrubs with opposite leaves, awnless achenes and white or nearly white flowers, *S. nelsonii* Rob., *S. lucida* Lag., and some forms of *S. salicifolia* Cav. are gummy and nearly glabrous; *S. phlebophylla* A. Gray, *S. glandulosa* Hook. & Arn., and the newly described *S. rzedowskii* are copiously stipitate-glandular. The others lack gland-tipped hairs, and if the foliage is gummy the phyllaries are pubescent. In three of these species (*S. scabrella* Benth., *S. subpubescens* Lag., and *S. dictyophylla* Rob.) the corolla is glabrous or pilose on the lobes only, whereas in *S. jaliscensis* Rob. and *S. myricoides* the corolla is pilose almost its whole length. *S. jaliscensis* and *S. myricoides* are very different, and may be effectively contrasted as follows:

1. Leaves densely soft-pubescent beneath, ovate-lanceolate, the petioles usually 1–2 cm long; achenes 3–4 mm long, the pappus a thin erose ring or collar 0.3–0.4 mm high; dry woodland or grassland, flowering October to January. *S. jaliscensis.*
1. Leaves glabrous (or the larger veins pilose), elliptic-lanceolate or -oblanceolate, scarcely petiolate; achenes 4–6 mm long, the pappus of white coriaceous opaque scales 0.4–0.6 mm long; humid montane forest, flowering January to April. *S. myricoides.*

Stevia porphyrea McVaugh, nom. nov. *Stevia purpurea* sensu Rob. Contr. Gray Herb. II. 90: 120. 1930, not *Stevia purpurea* Pers. Syn. Pl. 2: 402, nom. illegit. 1807.

AGUASCALIENTES: *Hartweg 135* (GH, type).

The name *Stevia purpurea* Persoon was superfluous when published because its author based it wholly or at least primarily on *Mustelia Eupatoria* Spreng. [*Stevia Eupatoria* (Spreng.) Willd.]. There is nothing in the protologue to indicate that Persoon saw a specimen. His description of the foliage differs only slightly (and probably not significantly) from that given by Willdenow in the *Species Plantarum*, and his description of the pappus is taken verbatim from Willdenow.

Stevia rzedowskii McVaugh, sp. nov.

Frutex viscidus 0.8–1-metralis, multiramosus, partibus omnibus stipitato-glandulosus, foliis rariuscule pilis glandulosis vestitis, bracteis phyllariisque interdum pilos glandulosos pilosque longos eglandulosos ferentibus; folia opposita, petiolata,

lanceolata, pennivenia, laminis 6–10 cm longis, 1.2–3 cm latis, 3–4-plo longioribus quam latioribus, apicibus acutis angustis attenuatis, marginibus supra basin acutam non profunde sed acute serratis, basi in petiolos subalatos 7–25 cm longos cuneatim decurrentibus; capitula 13–14 mm longa, in glomerulis bracteatis sessilia, glomerulis 1–5 cm pedunculatis axillaribus, inflorescentiis axillaribus dimidio brevioribus quam foliis subtendentibus vel eis subaequalibus; phyllaria 6–8 mm longa, membranacea,

FIG. 19. *Stevia myricoides* (Jalisco, *McVaugh 23461*). Flowering branch, X ½; involucrate cluster of heads, X 1.5; single flowering head, corolla, and achene, X 5; anthers, ca X 10.

lineari-lanceolata apicibus angustis attenuatis; corolla 8–8.5 mm longa, tubo brevi et fauce longiore, subcylindrica subrosea, crebre pilis erectis eglandulosis 0.3 mm longis obsita, et obscure glanduloso-puberulenti; faux sub basibus loborum albido-roseorum brevipilosorum ampliata, infundibuliformis; achaenia 4–5 mm longa, fere vel omnino glabra, nigrescentia, homomorpha, exaristata, annulo integro vel lobulato 0.2 mm alto coronata.

Species in honorem dixi cl. Jerzy Rzedowski (1926–), qui de plantis mexicanis egregie scripsit.

FIG. 20. *Stevia rzedowskii* (*Rzedowski 18262,* type). Flowering branch, X ½; involucrate cluster of heads, X 2; single flowering head, X 3.5; corolla and achene, X 5; anthers, X 10.

ZACATECAS: Mpio. de Juchipila, Cerro de Piñones, 4 km W of Pueblo Viejo, elev. 2000 m, 25 Jan 1964, *Rzedowski 18262* (MICH, type); mountain summits between Jalpa and Tlaltenango, elev. ca 2400 m, 23 Dec 1970, *McVaugh 25643.*

This plant is common in the open forests dominated by *Quercus resinosa,* on the high semi-arid ridges in southern Zacatecas. In many ways it resembles *Stevia glandulosa* Hook. & Arn., but in that species the leaves are ovate and about twice as long as wide, the corolla is shorter (ca 7 mm long) and the corolla-tube is gland-dotted, not pilose. *S. glandulosa* is a plant of the foothills of the Pacific Slope, at elevations from 1000 to 1500 m, whereas *S. rzedowskii* has a somewhat more inland range, and occurs in higher, dryer situations.

Stevia villaregalis McVaugh, sp. nov.

Herba perennis erecta 30–85 cm alta, caulibus foliosissimis solitariis vel paucis, basi usque ad 4–5 mm crassis, corymbo terminali composito convexo 5–16 cm longo latoque excepto simplicibus; caules inferne glabri; rami pedunculique sparsim pilis brevibus pallidis multicellularibus obsiti, rare resinoso-globuliferi sed non stipitato-

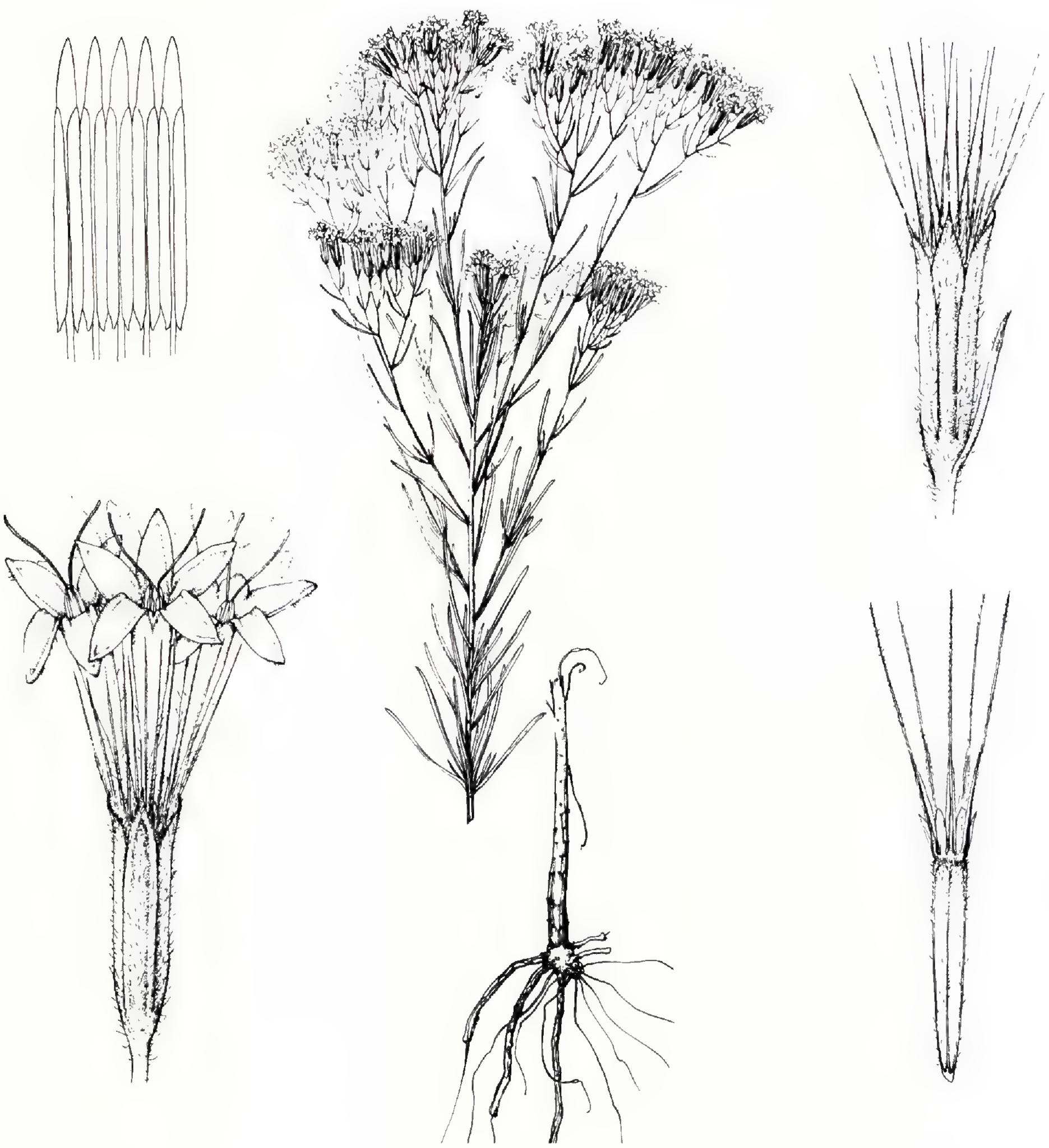

FIG. 21. *Stevia villaregalis.* Flowering plant, X ½ (*McVaugh 23867,* type). Flowering head, X 5; fruiting head and achene, X 5 (Jalisco, *Pringle 11579*); anthers, ca X 12.5 (*Pringle 11579*).

glandulosi; folia omnino glabra vel pilis grossis paucis munita, utrinque crebre globulis resinosis impressis instructa; folia caulinia alterna (ramulorum brevium sterilium opposita), numerosissima, valde adpresso-ascendentia, axillis saepe proliferis; folia linearia, sessilia, 2–6 cm longa, 1–2 mm lata, ad apicem obtusum crassicallosum angustata, uninervia, integra vel sub apice grosse utroque latere 1–2-dentata, carnosula, plana vel supra paullo concava; corymbi rami 10–20 vel numerosiores, valde ascendentes, bracteati, 3–4-plo furcati, capitulis plurimis terminalibus inflorescentiam compactam rotundatam formantibus; capitula 10–13 mm longa erecta, pedunculis maturis axillaribus 3–7 mm longis, capitulorum terminalium pedunculis 1–3 mm longis vel brevioribus; phyllaria 5.5–7 mm longa, oblonga, grosse pilosa et resinoso-globulifera, basi late obtuseque carinata, apice longe acuta et cuspidato-acuminata, apicibus triangularibus patentibus; corolla alba, 5–6 (–7) mm longa, tubo angusto faucem infundibuliformen subaequanti et in eam sensim transienti, lobis 1.5–2.5 mm longis, 1 mm latis, pilosis (corolla cetera glabra vel pilosa et resinoso-globulifera); antherae brunnescentes, 2 mm longae, appendicibus cinnamomeis oblongo-ovatis 0.5 mm longis; achaenia homomorpha, nigrescentia, clavato-linearia, (3.7–) 4.2–5 mm longa, distaliter praecipue strigosa, 5-aristata (raro achaenium unicum 4-aristata), aristis corollae tubo fere aequilongis, basi complanatis rigidisque, squamis angustis 0.7–1 mm longis alternantibus.

Species Luz María Villarreal de Puga, guadalajaranae, quae mecum plantas jaliscenses plurimas humanissime communicavit, grate nominavi.

NAYARIT: Pine-oak forest ca 40 km SE of Tepic, elev.1300 m, 4 Sep 1960, *McVaugh 18723.*

JALISCO: Periodically flooded meadows 13–14 km N of Ixtlahuacán del Río, with *Isoetes, Stevia serrata, Aster subulatus,* elev. 2000 m, 13 Sep 1967, *McVaugh 23867* (MICH, type); same locality, *Cronquist 10285, Villarreal de Puga 1272;* near Guadalajara, elev. ca 1500 m, 9 Oct 1903, *Pringle 11579;* 19 Sep 1886, *Palmer 534; Palmer 316, Pringle 2486, Barnes & Land 198a;* 17–18 km SE of Lagos de Moreno, grassland, elev. 1900 m, 7 Sep 1952, *McVaugh 12819;* 30 km E of Arandas, elev. 2100 m, 15 Nov 1970, *McVaugh 24408.*

Plants of this species are superficially like narrow-leaved specimens of the common *Stevia serrata* Cav., but differ in the readily observed characters of glabrous or nearly glabrous stem, strongly appressed and nearly glabrous, somewhat fleshy leaves that often lack sterile fascicles in the axils, and isomorphic 5-awned achenes. Where *S. serrata* and *S. villaregalis* have been found growing together, as at the type-locality of the latter, they are quite different in habit and aspect, and show no evidence of intergradation.

Tribe IV. Heliantheae

Bidens subspiralis McVaugh, sp. nov.

Annua, gracilis submetralis, caulibus 1–2 mm crassis, plusminusve tetragonis, angulis saltem et adaxiale prope ramorum bases pubescentibus; rami plerumque in axillis superioribus, interdum in axillis omnis oriundi; rami superiores inflorescentiam diffusam formantes, inferiores breviores; folia utrinque subtiliter strigosa; involucri basis et pedunculi pars distalis pilos paucos breves ferentes; phyllaria exteriora ciliata, interiora minute puberulentia; folia in foliola 3 lanceolata vel ovata, acuta vel attenuata, serrata pinnatisecta, foliolis lateralibus (vel rarissime omnis) interdum pinnatifidis; foliolum terminale multo longius, 2–5 cm longum (basi petioliformi ad 5 mm longa inclusa), 5–12 mm latum, utroque latere dentibus medianis 2–6 munitum; foliola lateralia sessilia vel breve petiolulata, quam terminalia dimidio minora, paullo angustiora, basi latiora, dentibus paucioribus; folia floralia bracteiformia, elliptica, integra, 1–4 cm longa; rami superiores 10–20 cm longi, semel aut bis furcati, capitulis solitariis vel quoque ramo 2–3, pedunculis filiformibus (2–) 4–10 cm longis; capitula sub anthesi 8–10 mm lata (ligulis patentibus mensa), 3.5–4.5 mm alta; involucrum

campanulatum, basi rotundata vel subtruncata pallidum et carnosulum; phyllaria exteriora 5–8, 1.5–3 mm longa, linearia vel sub apicibus acutis induratis paullo ampliata; phyllaria interiora ovata vel lanceolata vel elliptica, 2.5–3.5 mm longa, 0.7–1.3 mm lata, viridi-brunnea, costa fuscata, marginibus latis membranaceis pallidis, apicibus obtuse acuminatis; flores radii neutri sterilesque ca 5, ovario rudimentario

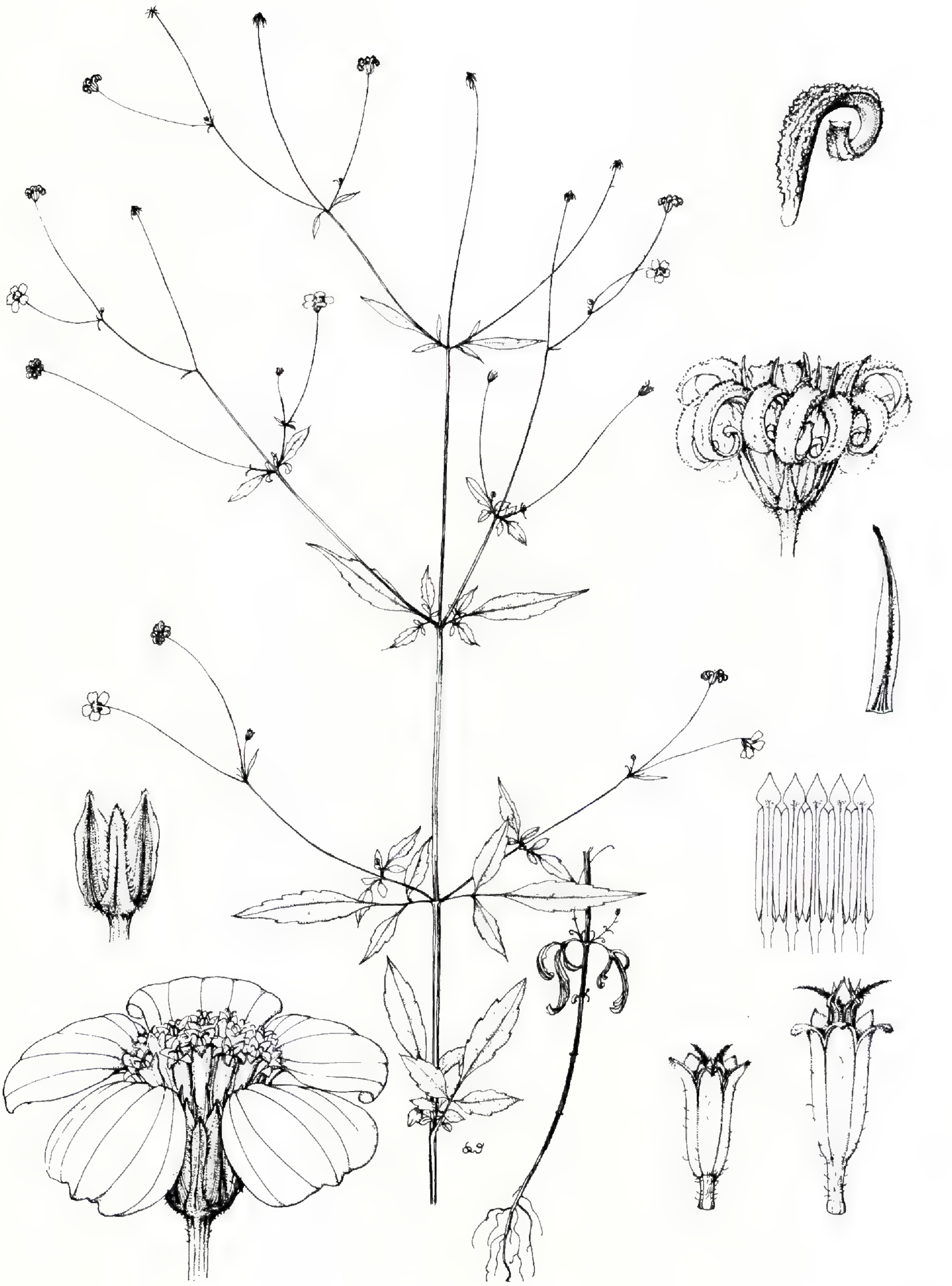

FIG. 22. *Bidens subspiralis* (*Feddema 2218*, type). Flowering and fruiting plant, X ½; fruiting head, flowering head, and detail of involcure, X 5; long and short disk-corollas, disk-achene, and pale, X 7.5; anthers, X 15.

2.5 mm longo vel breviore; ligulae albae, siccatae brunneo-lineatae, suboblongae, 3–3.5 mm longae, 2–3 mm latae, basi late rotundatae, apice subtruncatae dentatae; flores disci ca 15–20, corollis flavis, 2.7 (vel 3.7) mm longis, tubo brevi piloso, fauce campanulata, lobisque acutis triangularibus 0.7 mm longis; antherae purpureo-brunneae, 1.3 mm longae, basi auriculatae, appendicibus ovatis acutis 0.5 mm longis; styli ramuli 1.2 mm longi, applanati, ad apicem pilosum caudato-appendiculatum attenuati; achaenia lineari-fusiformia vel -clavata, 6–7 mm longa, 0.5–0.9 mm lata, nigrescentia, apice paullo angustata, truncata, tota longitudine valde dorsi-ventraliter compressa, distaliter in annulum vel cochleam laxam extrinsecus contorta; achaenii facies exterior rotundata, laevis, interior subplana, late bisulcata, marginibus porcaque acuta centrali tuberculata; pappus nullus; paleae subulatae 3 mm longae, costa brunnea, apicibus attenuatis; receptaculum 1–1.7 mm latum.

JALISCO: Mpio. de Tecalitlán, Mata de Bule, Sierra de los Corales, near upper limit of tropical deciduous forest with *Pseudosmodingium, Bursera, Lysiloma,* elev. 1300 m, 25 Oct 1963, *Feddema 2218* (MICH, type).

Unknown except from the type, this plant suggests a small-flowered, somewhat cut-leaved form of *Bidens pilosa,* except for the extraordinarily coiled and ornamented awnless achenes. Heads with long corollas, and those with the shorter corollas, may be found on the same plant.

Calea colimensis McVaugh, sp. nov.

Frutex arcuatus vel herba gigantea basi lignosa, caulibus 2–4 m longis subsimplicibus, inferne glabris vel per pilorum bases rigidos persistentes asperatis, ramulis hispidis, inflorescentia pedunculisque per pilos rigidos graciles ascendentes dealbatis; folia supra scabridula, subtus in venis pilos multos rigidos vitreos munita; phyllaria ciliata, cetera quasi glabra; folia ramique oppositi, tantum inflorescentiae ramuli minimi alterni vel irregulariter fasciculati; folia principalia elliptico-ovata vel -lanceolata, 8–14 cm longa, 2.5–6 cm lata (ramorum lateralium florentium saepe dimidio minora), sensim acuminata saepeque falcata, triplinervia, ad basin e medio vel infra sensim rotundata vel attenuata, marginibus remote denticulatis vel serrulatis, in petiolos 5–15 mm longos cuneatim decurrentibus; inflorescentia subcorymbosa vel rotundata, compacta, pauciramosa, ad 50–75-cephala, ramulis subnudis e nodis foliosis terminalibus 1–2 orinudis, capitulis latis, 8 mm altis, compressis 6–8 mm latis, pedunculis 2–10 mm longis; involucrum late campanulatum 5 mm longum, 3–4-seriatum, basi rotundatum; phyllaria 20–30, alboviridia, basi rigida, apicibus membranaceis; phyllaria exteriora gradatim breviora, extima brevissima 5–8 obtusa vel subacuta, mediana elliptica vel oblonga 1–2.5 mm lata, marginibus membranaceis apicibusque obtusis tenuibus; phyllaria interiora interdum augustiora, subacuta; bracteae lineares quam phyllaria angustiores plerumque aliquos disci flores marginales subtendentes, sensim in paleas transientes sed integrae non ut in paleis lateraliter dentatae; flores radii 5–9 vel nulli, ligulis (quae absunt) ut videtur flavidis, 1.5–2 mm longis, 1–1.5 mm latis, apice 3-dentatis, tubo dense piloso 2–2.5 mm longo; flores disci ca 25–30, corollis luteis vel aureis, 4.5–6 mm longis, anguste tubuloso-infundibuliformibus, externe densiuscule pilosis, lobis interne papillosis 0.6 mm longis; antherae ca 1.6–1.7 mm longae, basi auriculatae, appendicibus trullatis 0.4 mm longis; styli ramuli lineares, applanati, 1 mm longi, prope apices subacutos pilosi; achaenia 1.5–1.7 mm longa, subdimorpha, radii nigra, glabra, epapposa, dorsi-ventraliter compressa, ambitu anguste obovata, incurvata, dorso convexa, facie interiori angulata; achaenia disci obpyramidalia, leniter 4–5-angulata, crebre pilis rigidis partim bifurcatis subappressis hirsuta; pappi setae albae subulatae planae ca 20, barbellatae, 3–5 mm longae; paleae ca 5 mm longae, angustae, membranaceae, acutae vel apice subulatae, plerumque dentibus 2 grossis lateralibus munitae; receptaculum breviconicum, 1 mm latum, paleis centralibus persistentibus.

TYPE: JALISCO: Nevado de Colima, SE slopes, in fir-forest, elev. 2850 m, 2 Apr 1951, *McVaugh 11704* (MICH).

This species is evidently very closely related to *Calea integrifolia* (DC.) Hemsl., but the flower-heads are conspicuously larger than those of *C. integrifolia*, and the parts of individual disk-flowers, especially the corollas and the pappus, are consistently larger. The most easily observed difference between the two is in the ligules, which in *C.*

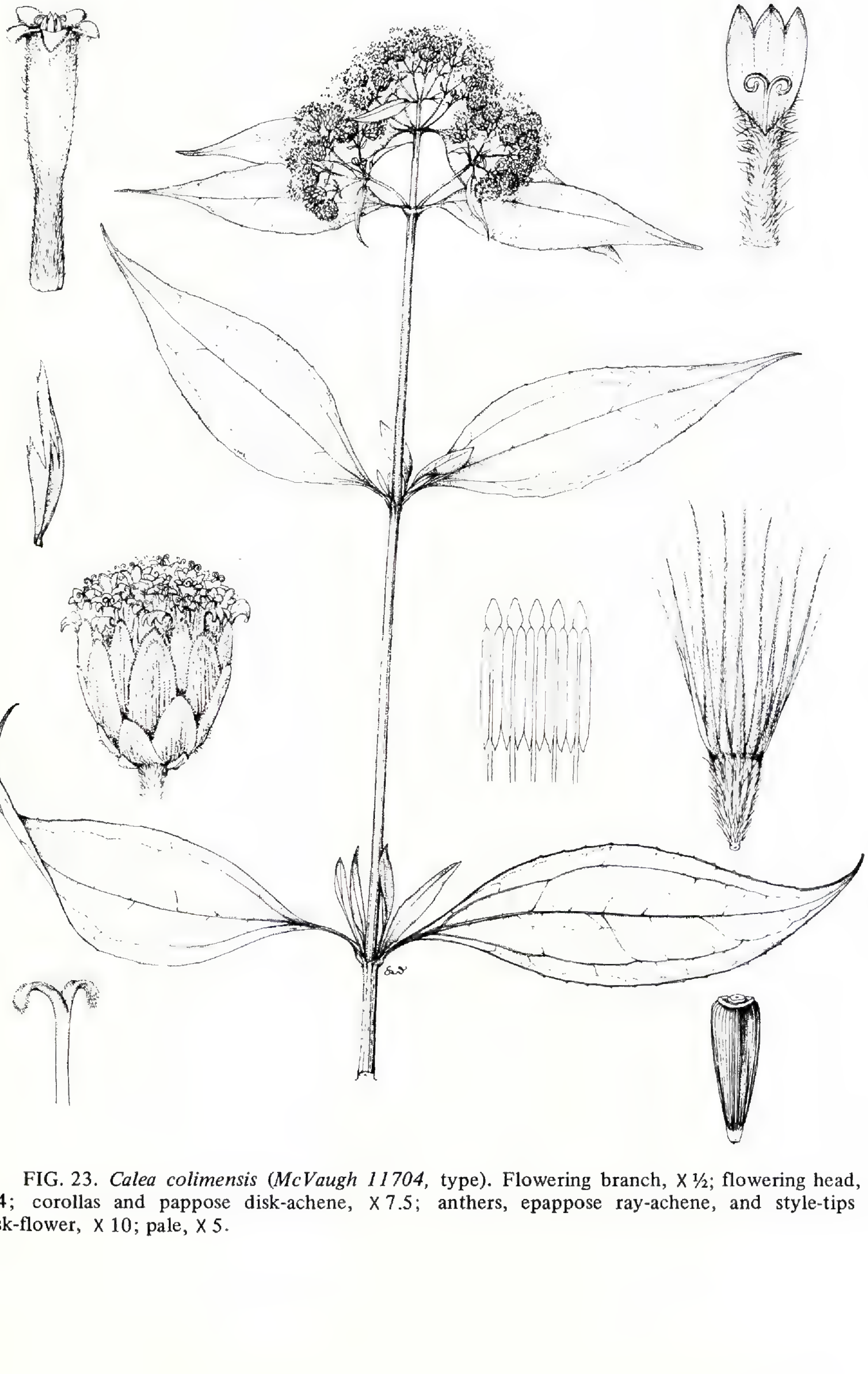

FIG. 23. *Calea colimensis* (*McVaugh 11704*, type). Flowering branch, X ½; flowering head, ca X 4; corollas and pappose disk-achene, X 7.5; anthers, epappose ray-achene, and style-tips of disk-flower, X 10; pale, X 5.

colimensis are greatly reduced or wanting; *C. integrifolia* is not well known in western Mexico, but ranges far southeast of our limits into Central America.

Additional specimens of *C. colimensis* examined:

JALISCO: Nevado de Colima, NW slopes, barranca in fir forest above El Izote, elev. 2500–2600 m, 28 Mar 1949, *McVaugh 10086;* Nevado de Colima, northern slopes, in oak forest, elev. 2200–2500 m, 1 Apr 1951, *McVaugh 11671;* 25–30 km SE of Autlán, humid forest near summits between El Chante and Cuzalapa, elev. 2000–2250 m, 19–22 Mar 1965, *McVaugh 23101.*

Calea scabra (Lag.) Rob., var. **palustris** McVaugh, var. nov.

A varietatibus ceteris hujus speciei foliis glabris, a var. *pedunculari* pappi setis obtusis vel acutis 1.3–3 mm longis interdum breviaristatis differt; paludes habitat.

NAYARIT: Wet meadows in oak zone 6–8 km N of Compostela, elev. 800–900 m, 5 Sep 1960, *McVaugh 18732* (MICH, type); open wet areas ca 32 km SE of Tepic, 10 Aug 1960, *King 3676.*

Superficially similar to the upland varieties of *Calea scabra,* this plant is apparently restricted to marshy habitats. The herbage is always glabrous except in the inflorescence, where as in var. *scabra* the leaves are strigose or pilose beneath. Strictly speaking, the name var. *scabra* applies to a form in which the achenes are epappose; in the so-called var. *pedunculariS* (H.B.K.) Rob., the pappus is usually 0.6–1 mm long, rarely as much as 2 mm.

Chrysanthellum filiforme McVaugh, sp. nov.

Annua, gracilis, erecta 10–40 cm alta radice palari, glabra (basi involucri minute glanduloso-pubescens), caulibus solitariis vel paucis, plerumque supra medio pauciramosis, quoque ramo capitula 1–2 pedunculis filiformibus 4–9 cm longis ferenti; folia alterna vel ex parte ad basin caulis rosulata, laminis in ambitu ovatis, (1–) 2–6 cm longis, in segmentis acutis linearibus integris pinnatim semel aut bis dissectis, segmentis ultimis 2–10 mm longis, 0.8 mm latis vel angustioribus; rhachis 0.5–0.8 mm lata; foliorum caulinium petioli 3–10 (–25) mm longi, basalium 2–5 cm longi, quam laminae saepe longiores; capitula erecta, 1.3–1.8 cm lata (ligulis patentibus mensa), sub anthesi 6–10 mm alta, bicoloria, radiis aurantiacis sed disco castaneo-rubro; involucrum castaneum, campanulato-infundibuliforme, 4–5 mm altum, phyllariis interioribus 8–9 distinctis, subaequalibus, membranaceis, glabris, coloratis, lanceo-ovatis vel ellipticis vel obovatis, obtusis, 1.3–2 mm latis, marginibus latis subhyalinis; phyllaria exteriora 5, appressa, lanceo-subulata, 1.5–2.5 mm longa, basi gibba, glanduloso-puberulentia; flores radii 9–15, fertiles, ex parte phyllariis interioribus, parte bracteis linearibus coloratis, inter phyllaria et paleas intermediis, subtenti; ligulae obovato-cuneatae, 4–7 mm longae, apice obtusae vel emarginatae, in siccitate pallidae, venis 4 (–6) brunneis; tubus 0.5 mm longus, glaber; styli ramuli 0.5 mm longi; flores disci 20–30, hermaphroditi sed steriles, corollis castaneis glabris 4–5.5 mm longis, tubo angusto 1–1.5 mm longo, fauce cylindro-campanulata, lobisque crassis atrocastaneis ovatis obtusis, 0.3–0.4 mm longis; antherae basi obtusae, appendicibus obtusis inclusis 1.5–1.8 mm longae, styli ramuli erecti, 1.3–1.6 mm longi, papilloso-hispiduli, apicibus attenuatis; achaenia radii plerumque 8 (cetera non maturantia), pallide brunnea, 3.5–4 mm longa, clavata subteretiaque, paullo incurvata, 1–1.3 mm crassa, glabra laeviaque vel raro distaliter tuberculata, apice rotundata, breve coronata, basi paullo incrassata suberosaque, longitudinaliter 6–10-sulcata, porcis obtusis; pappus nullus; florum disci ovaria rudimentaria linearia 1.5–5 mm longa, versus centrum capituli longitudine sensim crescentia, paleis filiformibus persistentibus 3–4 (–5.5) mm longis, saepe quam ovariis paullo longioribus, subtenta; receptaculum convexum.

TYPE: MICHOACAN: Summit of Cañón el Marqués, ca 8 km N of Nueva Italia, ungrazed hillsides in *Bouteloua* grassland, elev. 450–500 m, 19 Sep 1958, *McVaugh 18030* (MICH).

Unknown except from the type-locality, this species differs markedly in habit and in leaf-form from any other *Chrysanthellum* known to me. In the widespread *C. americanum* (L.) Vatke there is some tendency toward sterility of the disk-flowers, and

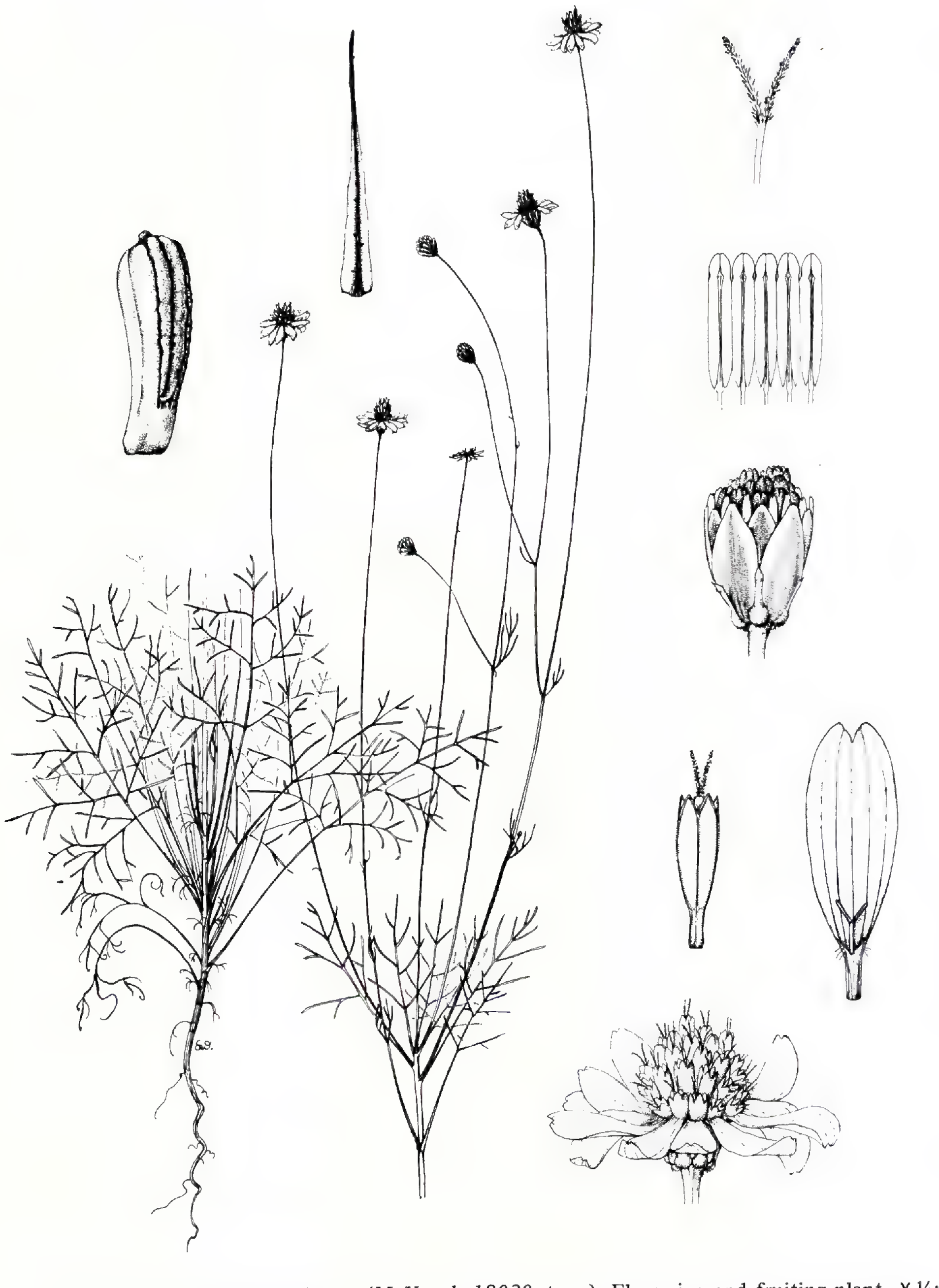

FIG. 24. *Chrysanthellum filiforme* (*McVaugh 18030*, type). Flowering and fruiting plant, X ½; flowering head, X 2; head in bud showing involucre, X 3; corollas, X 5; achene, and style-tips of disk-flower, X 7.5; anthers, and pale, X 10.

apparently the affinities of *C. filiforme* are with *C. americanum*, not with *C. mexicanum* Greenm., which is common in various parts of Nueva Galicia.

Dyssodia porophyllum [as *porophylla*] (Cav.) Cav. An. Ci. Nat. 6: 334. 1803. *Pteronia porophyllum* Cav. Ic. 3: 13. *pl. 225*. 1795.

The specific epithet has been spelled *porophylla* by many authors, first by Cavanilles himself when he made the new combination under *Dyssodia*, and soon

thereafter by Lagasca (1816) and DeCandolle (1836). This can be justified under the Code only if it can be shown that the original spelling, *porophyllum,* was published because of a "typographic or orthographic error." Although the possibility of such an error cannot be ruled out, it seems much more likely that Cavanilles first intended to use *Porophyllum* as an epithet in apposition, and later changed his mind, without realizing that under 20th Century rules of nomenclature he would not have the right to do so.

Cavanilles' original specimen (at MA; MSC photo 4808), representing a plant cultivated at the Royal Botanical Garden in Madrid in 1793, is labelled "*Pteronia porifolia,*" suggesting that at first he contemplated still a third form of the epithet. Another specimen from the Madrid Garden, cultivated in 1803 (i.e. the same year as the publication of *Dyssodia "porophylla"*), bears the name "*Dyssodia porophyllum* H[ort.] R[eg.]," and on the same label the synonymous name "*Pteronia porophyllum* Cav. Ic. ta[b]. 225" (MSC photo 4842). This of course supports the assumption that *Dyssodia porophyllum* (in that exact form) was used at the Madrid Garden, was presumably known to Cavanilles himself, and was not invented by Willdenow or some other author. Willdenow seems to have gone back intentionally to the original spelling in using the name *Dyssodia Porophyllum* (Enum. Hort. Berol. 2: 900. 1809), as does Kunth (H.B.K. Nov. Gen. & Sp. 4: 198. 1820) in making the new combination *Boebera Porophyllum.* Rydberg (N. Am. Flora 34: 163. 1915) to cite a more recent example, used the combination *Lebetina Porophyllum,* not accepting Aven Nelson's (1909) spelling *porophylla.*

Encelia linearis McVaugh, sp. nov.

Perennis, herbacea, caulibus solitariis vel paucis, erectis, foliosissimis, 30–65 cm altis, 1–2 mm crassis, e caudice crassa lignosa oriundis; caules angulati, inferne pubescentibus, pedunculis paullo pilis brevibus appressis dealbatis; phyllaria hirsutula; folia sparsa, numerosissima (100–200), linearia, valde revoluta, calloso-denticulata sed ut videtur integra, (1–) 2–4.5 cm longa, 0.7–1.5 mm lata, sessilia, apice obtusa, supra glabra vel scabridula, subtus alba denseque brevipilosa, area inter margines revolutos pilis obtecta, nervo medio glabro, pallido, basi ampliato et angulo in caulem decurrenti; capitula solitaria vel pauca, caulem et ramos superiores rigidos valde ascendentes terminantia, pedunculis 8–15 cm longis, 1–2 mm crassis, sub capitulis ampliatis; capitula sub anthesi non visa, verisimiliter brevicampanulata, fructifera ca 1 cm lata; phyllaria ca 11–15, lanceolata, obtusa vel attenuata, 5–6 mm longa, 1.5–2 mm lata, exteriora (ca 8) angustiora, breviora, obtusa, 1–1.5 mm lata; flores radii ut videtur steriles, achaeniis juvenilibus trigonis, ligulis angustis ca 1 cm longis; flores disci 50 vel ultra, corollis 3.7 mm longis; antheris appendicibus inclusis 1.7–2 mm longis; achaenia disci paullo immatura 2.5–3 mm longa, planissima, ambitu obovoidea, versus apicem ciliata, quaque facie obscure angulata, aristam debilem ad 1 mm longam quoque margine ferentia; squamellae nullae; paleae conduplicatae ca 5 mm longae, scariosae, rigidae, acuminatae, deciduae; receptaculum valde convexum, 3–6 mm latum, 2–4 mm altum.

TYPE: JALISCO: Rocky hills, grassy openings in dry oak forest 6–7 km NW of Cuautla, road to Los Volcanes, elev. 1700–1750 m, 9 Oct 1960, *McVaugh 19995* (MICH). Unknown except from the type collection.

This plant resembles no other Mexican Composite known to me. It is assigned to *Encelia* because of the narrow alternate leaves, the very flat disk-achenes with 2 weak awns, and the presumed sterility of the ray-flowers.

Galinsoga mollis McVaugh, sp. nov.

Herba annua (?) 1.5-metralis, multiramosa, omnibus partibus fere hirsutula, pilis gracillimis vitreis attenuatis multicellularibus, caulium petiolorumque longioribus 2–3 mm longis, foliorum plerumque 1 mm longis vel brevioribus, ramulorum

pedunculorumque brevioribus, appressis; phyllaria ciliata, cetera glabra; folia et rami majores oppositi, inflorescentiae ramulis parvis saepe alternis; folia tenuia, triplinervia, elliptico-lanceolata, 5–15 cm longa, 2–3.7 cm lata, sensim longiacuminata, ad basin attenuata vel paullo rotundata, petiolis 5–15 mm longis, marginibus remote calloso-denticulatis; folia superiora et ramulorum superiorum multo minora, subsessilia,

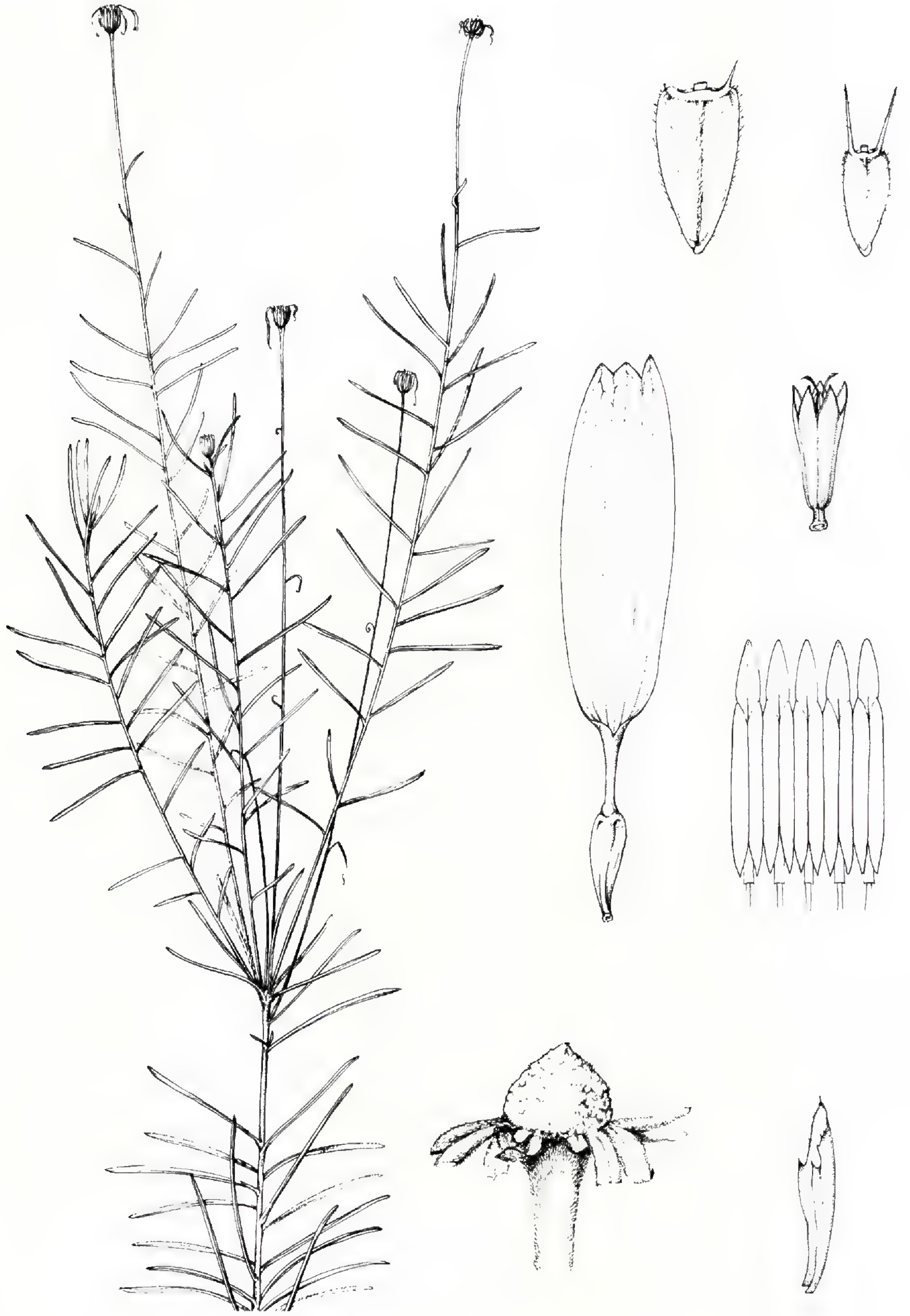

FIG. 25. *Encelia linearis* (*McVaugh 19995*, type). Terminal portion of over-mature fruiting plant, X ½; over-mature receptacle, X 2.5; corollas, and pale, X 5; immature achenes, ca X 5–6; anthers, ca X 17.5.

lanceolata, 1–5 cm longa; inflorescentia diffusa paniculiformis, plantae dimidium superius obsidens, ramis majoribus ad 50 cm longis, capitulis quoque ramo paucis vel ad 10, pedunculis 1.5–4 cm longis; capitula 1.5–2 cm lata (ligulis patentibus mensa), radiis exceptis subglobosa, 6–7 mm alta; involucrum basi late rotundatum vel centro depressum, ca 4 mm altum, 6–7 mm latum; phyllaria 13–16, basibus rigidis, striatis, marginibus apicibusque obtusis membranaceis, exteriora gradatim breviora, extima ca 4–6 quam ceteris multo minoribus 1.5–3 mm longis; phyllaria interiora ca 8, radii achaenia subtendentia, late elliptica vel obovata, dorso valde convexa, 2–2.5 mm lata, cum bracteis 2 adjacentibus lineari-oblongis, obtusis, integris, 0.5–1 mm latis, et achaenio incluso *Galinsogae* modo secedentia; flores radii ca 8, ligulis albis 4–7 mm longis, 2.5–3.5 mm latis, apice 3-dentatis, tubo hirsuto 2 mm longo; styli ramuli exserti 1 mm longi, laeves, lineares, adaxiale applanati sulco mediano; flores disci plurimi (125–150), corollis flavidis 2.5–2.8 mm longis, basi pilosis, tubo angusto 1 mm longo, fauce subcylindrica, lobis ovato-triangularibus 0.5 mm longis, utrinque papillosis; antherae 1 mm longae, basi subauriculatae, appendicibus tenuibus ovatis acutis 0.3 mm longis; styli ramuli 0.7 mm longi; achaenia 1.1–1.5 mm longa, glabra, nigrescentia, epapposa, subdimorpha, clavata vel obpyramidalia, apice truncata, basi carpopodio pallido abrupte incurvo instructa, radiorum paullo compressa, incurva, dorso (abaxiale) convexa, ventro angulata, disci clavato-columnaria, 4–5-angulata; paleae membranaceae lineares 2.5 mm longae, apice erosae, obtusae, plerumque dentibus 2 (–1) lateralibus munitae; receptaculum conicum, 1.5–2 mm altum et subaequilatum, paleis saltem interioribus persistentibus.

TYPE: 20–22 km S of Talpa de Allende, headwaters of a west branch of Río de Talpa, steep mountainsides in pine forest, elev. 1200–1450 m, 28–30 Mar 1965, *McVaugh 23300* (MICH). Unknown except from the type-collection.

The separation of a phyllary with 2 attached lateral bracts or inner phyllaries, and a pale within, the whole inclosing one of the peripheral achenes and falling with it, was noted long ago in this genus by Rafinesque and by DeCandolle. More recently it was described by Blake as a unique attribute of *Galinsoga*. In fact the same condition may be noted in a few species of *Tridax*, which is maintained as a genus distinct from *Galinsoga* perhaps more because of tradition than for taxonomic reasons.

The differences between the newly described *Galinsoga mollis* and the common *G. parviflora* Cav. may be expressed as follows:

1. Rays usually about 5; disk-flowers about 25, their corollas 1.2–1.6 mm long; pappus often present. *G. parviflora.*
1. Rays usually about 8; disk-flowers 125–150, their corollas 2.5–2.8 mm long; pappus none in ray or disk. *G. mollis.*

Guardiola mexicana Humb. & Bonpl., var. **angustifolia** (A. Gray) McVaugh, comb. nov. *Guardiola tulocarpus* var. *angustifolia* A. Gray, Proc. Am. Acad. 22: 423. 1887. *Guardiola angustifolia* (A. Gray) Rob. Bull. Torrey Bot. Club 26: 235. 1899.

This plant, unknown except from the *barranca*-systems of the Río Grande de Santiago in Jalisco, is excluded from *Guardiola tulocarpus* because of the lack of a caruncle on the achene. Superficially it seems quite different from *G. mexicana*, which has broader and often hastately toothed leaves, ray flowers 2–4 (as against 1–10). None of these characters is entirely diagnostic, however, and the two taxa are so much alike in other characters of involucres, flowers, and achenes, that it seems unrealistic to treat them as separate species.

Hydropectis stevensii McVaugh, sp. nov.

Annua, erecta, glabra, ramosa, 10–25 cm alta, e radice brevi erecta; folia ramique oppositi, vel folio summo vel bractea pedunculi interdum alterna; folia 2–5 cm longa, linearia integraque, vel pinnatipartita lobis linearibus ad 1 cm longis utroque latere 1–2; laminae, vel foliorum lobatorum lobi rhachidesque 1 (–2) mm latae, apicibus callosis obtusis; foliorum bases paullo dilatatae brevissimeque connatae; glandulae

foliares rotundae, diametro 0.1–0.2 mm, immersae, plurimae, nervi medii utroque latere uniseriales; capitula usque ad 10–25, vel in quoque ramo principali 10–25; ramificatio cymosa, capitulis centralibus vetustioribus a ramis junioribus multo superatis; capitula vulgo terminalia, pedunculis brevibus 5–15 mm longis, sub capitulis ampliatis, nudis vel unibracteatis, bractea lineari obtusa; capitula hemisphaerica, ut

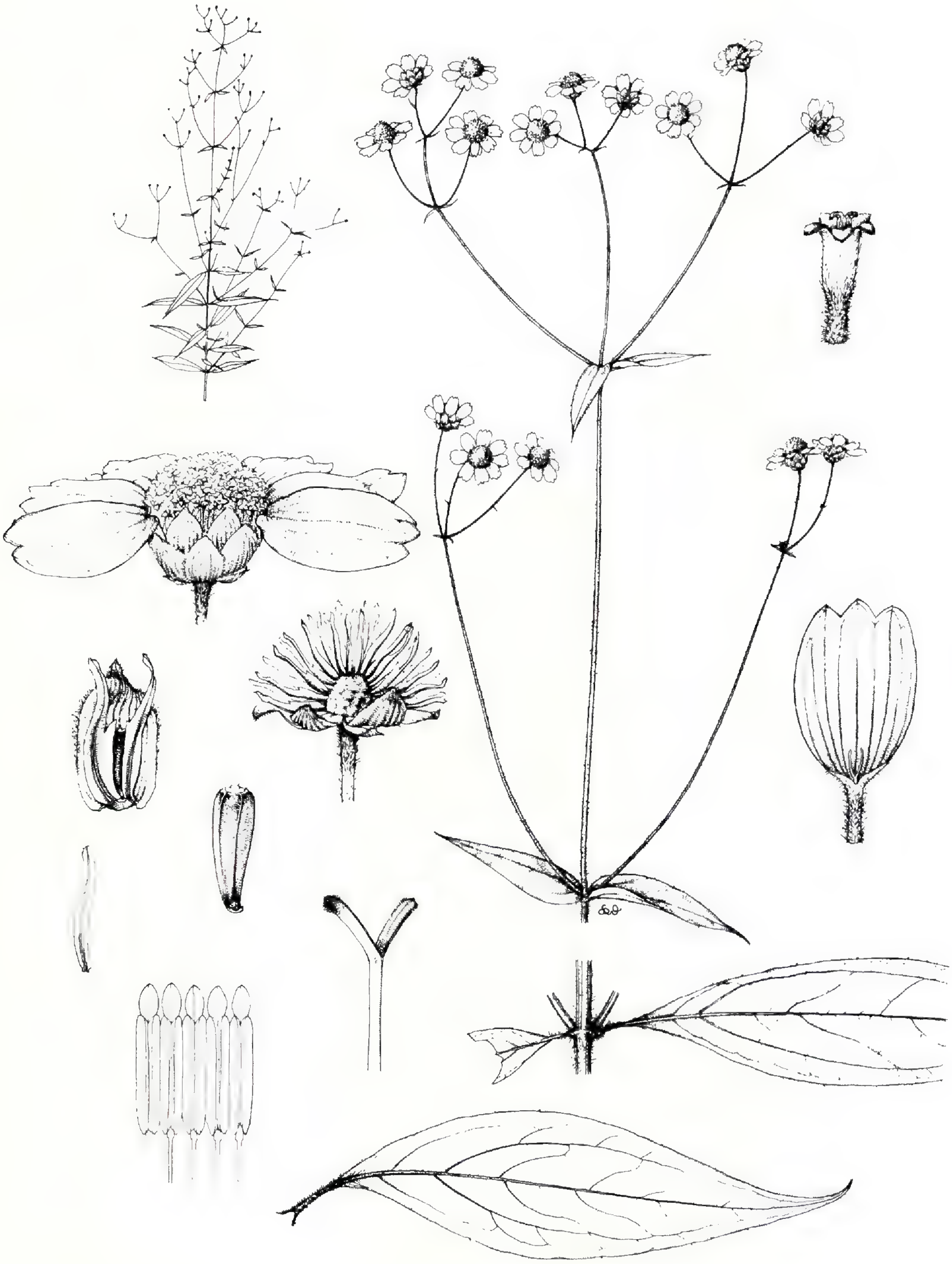

FIG. 26. *Galinsoga mollis* (*McVaugh 23300*, type). Diagram of inflorescence, greatly reduced; leaves and terminal portion of inflorescence, X ½. flowering head with 2 rays removed, X 2.5; over-mature fruiting head with pales partly removed, X 3.5; disk-corolla, X 6; ray-corolla, X 3; inner phyllary with attached lateral pales and included achene, and detached central pale below, X 5; achene, X 10; anthers and style-branches, X 15.

videtur discoidea, ligulis minutis; involucrum crateriforme, phyllariis 5 subaequalibus, distinctis, elliptico-obovatis, 3–4 mm latis, omnino membranaceis, parallelinerviis sed nervo medio haud manifesto, apicibus tenuissimis erosis purpurescentes late rotundatis; phyllaria eglandulosa, vel prope apices nervorum glandulis paucis angustissime linearibus elongatis instructa; flores marginales ca 20–23, feminei fertilesque, biseriati, corollis pallide flavidis, tubo angusto ligulaque elliptica 0.5 mm longa inclusa 1.3–1.5 mm longis; flores disci centrales 30–40, corollis flavidis subcylindricis 1.5 mm longis, lobis 4–5 ovato-triangularibus 0.3 mm longis; antherae albidae, basi obtusae, appendicibus breve ovatis inclusis 0.5 mm longae; styli ramuli 0.3 mm longi, ex antheris vix exserti

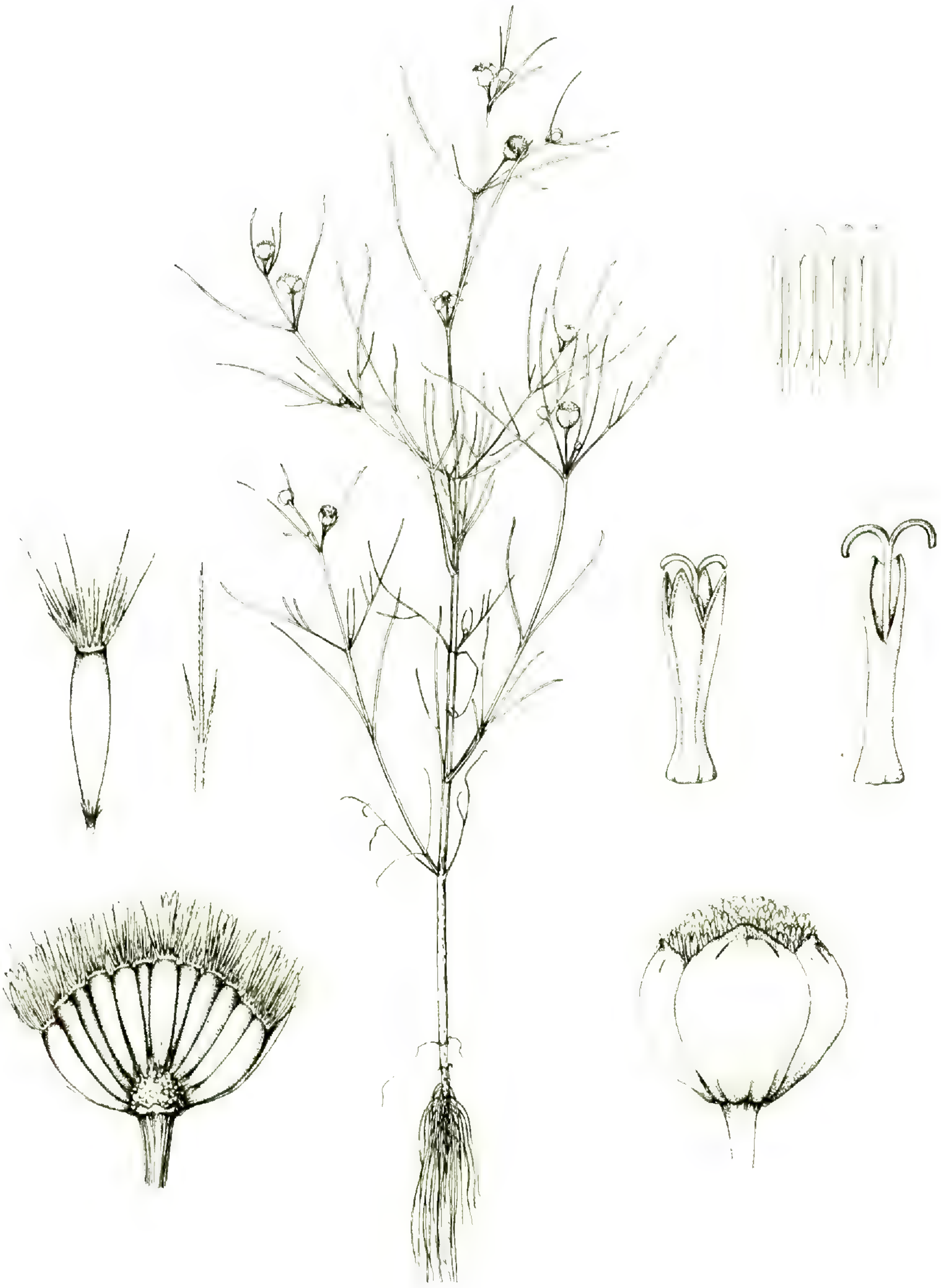

FIG. 27. *Hydropectis stevensii.* Flowering and fruiting plant, X ½ (*McVaugh 17611*). Flowering head, and fruiting head with flowers partly removed, X 5; achene, X 7.5; detail of pappus-bristle, X 12.5; corollas, X 15; anthers, X 25. All details from the type (*McVaugh 17078*).

paullo applanati, elliptici, obtusi, vix papillosi, lineis stigmaticis marginalibus ad basin extensis; achaenia 2.3–2.5 mm longa nigrescentia, clavata, teretia vel paullo compressa, striata, basi pilis bifurcatis appresse strigosa; pappi squamellae ca 15–20 valde inaequales angustae, aristatae vel plerumque in aristis setiformibus 3–5 divisae, aristis longioribus 1.3–1.5 mm longis; receptaculum late conicum 1.5 mm latum, per cicatrices prominentes achaeniorum asperatum, vetustate phyllariis laxe reflexis pallidis circumcinctum.

Species comiti Warren Douglas Stevens (1944-), qui mecum anno 1970 per terram mexicanum lustravit, nominavi.

JALISCO: In mud and shallow water, depressions in level grassland, along the Ojuelos-Aguascalientes highway near km 45, E of Tacubaya, elev. 2000–2050 m, 17 Aug 1958, *McVaugh 17078* (MICH, type); depressions in grassland, 13 mi [25–26 km] W of Lagos de Moreno, elev. 1900 m, 1 Sep 1958, *McVaugh 17611.*

GUANAJUATO: Depressions in grassland, 11–12 km W of Dolores Hidalgo, elev. 1950 m, 9 Nov 1970, *McVaugh 24074.*

Originally discovered during the unusually wet summer of 1958, this species was not found again until Mr. Stevens detected it growing with *Jaegeria glabra* and other Compositae in the Guanajuato grasslands in 1970. Apparently it, like other plants of similar habitat preference, can survive a series of unfavorable seasons when rainfall is so light that the seasonal pools in the grassland are not formed.

One other species of *Hydropectis, H. aquatica* (S. Wats.) Rydb., is known from western Chihuahua. It is said to have discoid 10–12-flowered heads and achenes 6–8 mm long. It was originally described as a species of *Pectis.* The 2 known species of *Hydropectis* agree in having the marginal flowers of the disk tubular or with very short ligules (not with showy ligules as in *Pectis*), in having short obtuse styles (as in *Pectis* but not in the group that includes *Tagetes, Dyssodia* and related genera), and in the aquatic or subaquatic habitat. I originally thought that *Hydropectis stevensii* might represent an aberrant species of *Dyssodia*, and I am indebted to Dr. John L. Strother for reminding me of *Hydropectis.*

Jaegeria sterilis McVaugh, sp. nov.

Herba erecta, verisimiliter annua, 10–20 cm alta, ramosa, ramis superne cymose furcatis; caules pilosi, pilis pallidis, appressis, debilibus, multicellularibus, pedunculis per pilos similes ad 1 mm longos paullo dealbatis; phyllaria dimidio proximali grosse pilosa, pilis marginalibus attenuatis rigidioribus ad 1 mm longis fere usque ad apices munita; folia sessilia, connato-perfoliata (foliorum principalium basi vaginanti 1.5–2 mm lato), subtus manifeste pallidiora, tota fere glabra sed pilis longis marginalibus pilisque paucis superficialibus instructa; laminae ovato-lanceolatae (vel superiores lanceolatae inerioresque oblongo-ellipticae), 1–3.5 cm longae, (3–) 5–15 mm latae, basi rotundatae, ad apices obtusos attenuatae vel inferiores obtusae, marginibus principalium saltem denticulatis; inflorescentia diffusa, caule plerumque ad nodum tertium vel quartum in pedunculum 3–6 cm longum terminanti, pedunculo mox ramis axillaribus 1–3-plo furcatis superato, capitulis itaque ad 30 vel ultra (in plantis parvis paucis), 1–1.5 cm latis (radiis extensis mensis), sub anthesi 4–6 mm altis, fructiferis 6–8 mm altis; involucrum basi rotundatum vel statu fructifero subtruncatum; phyllaria ca 8 (6–9), basi unita sed non imbricata, appressa, lanceolata, acuta, 3–4.5 mm longa, versus basin fimbriato-ciliata, alis interioribus 2–2.5 mm longis, ciliatis, apice abrupte rotundatis; flores radii tot quot phyllaria, neutri vel feminei, plerumque steriles, ligulis flavis oblongo-ellipticis, 4–6 mm longis, 2.5–3.5 mm latis, obtusis, glabris, tubo 0.2 mm longo; stylus vel nullus vel ca 2 mm longus, parte indivisa quam ramis linearibus applanatis obtusis longiore; ovarium sterile 2 mm longum; achaenia rarissime maturantia; flores disci numerosi (ca 35–60), corollis flavidis 1.5–2.5 mm longis, tubo minus quam 1 mm longo, basi dilatato glabroque vel rare piloso, lobis 5 (–4) late triangularibus 0.4–0.5 mm longis, intus papillosis; antherae pallide virides, appendicibus

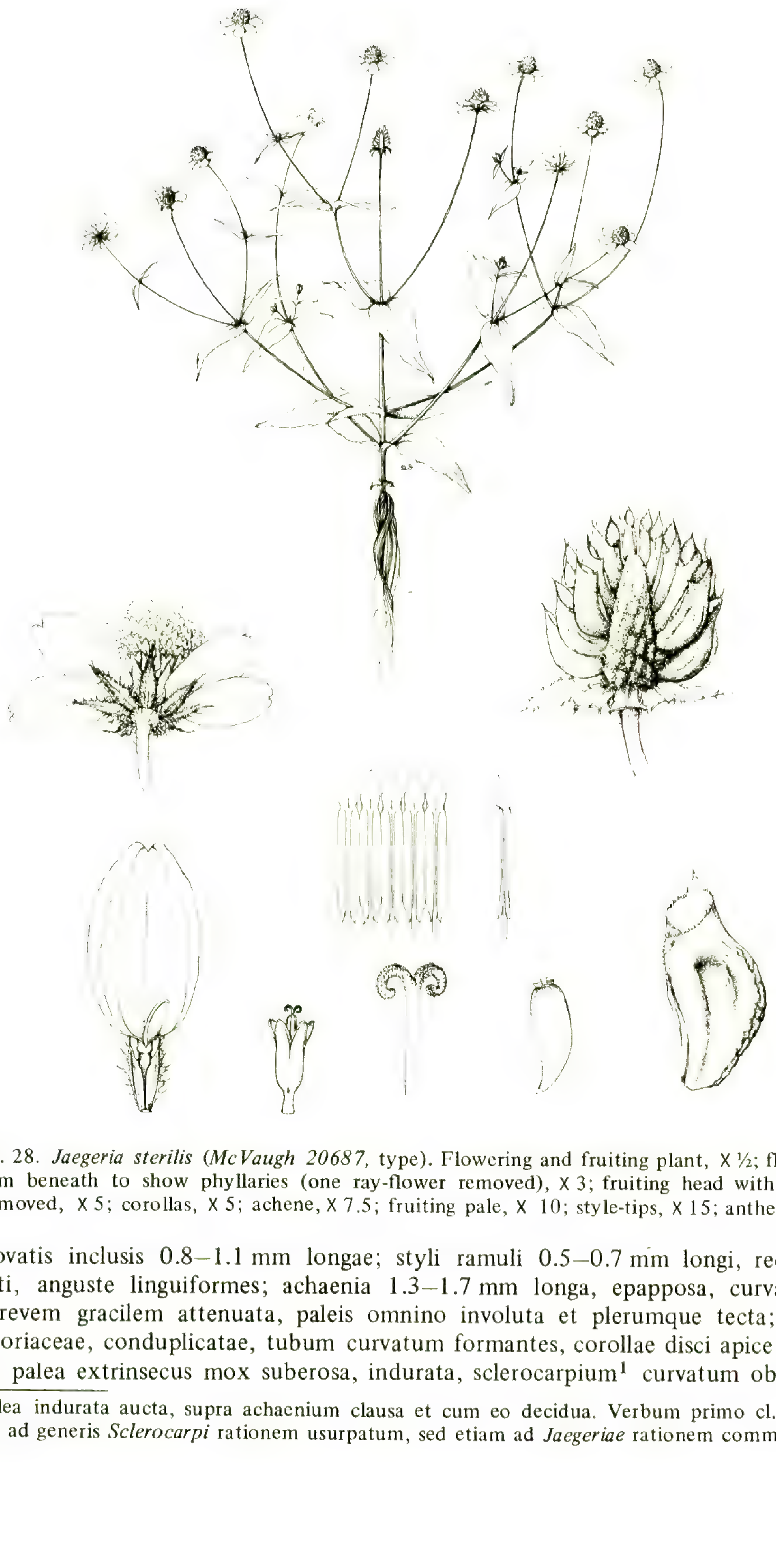

FIG. 28. *Jaegeria sterilis* (*McVaugh 20687*, type). Flowering and fruiting plant, X ½; flowering head from beneath to show phyllaries (one ray-flower removed), X 3; fruiting head with flowers partly removed, X 5; corollas, X 5; achene, X 7.5; fruiting pale, X 10; style-tips, X 15; anthers, X 20.

acutis ovatis inclusis 0.8–1.1 mm longae; styli ramuli 0.5–0.7 mm longi, recurvati, applanati, anguste linguiformes; achaenia 1.3–1.7 mm longa, epapposa, curvata, ad basin brevem gracilem attenuata, paleis omnino involuta et plerumque tecta; paleae primo coriaceae, conduplicatae, tubum curvatum formantes, corollae disci apice e tubo exserto; palea extrinsecus mox suberosa, indurata, sclerocarpium[1] curvatum obliquum

[1]Palea indurata aucta, supra achaenium clausa et cum eo decidua. Verbum primo cl. Charles Feddema ad generis *Sclerocarpi* rationem usurpatum, sed etiam ad *Jaegeriae* rationem commodum.

formans; sclerocarpium dorso plusminusve porcatum, basi truncatum, 1–1.3 mm crassum, 2.5–3 mm longum, marginibus apicalibus tenuibus in tubum 0.5–0.7 mm crassum involutis, tubi orificio obliquo, subtruncato, abaxiale breviaristato; marginibus sclerocarpii proprii latis tenuibusque, non imbricatis sed superficiebus interioribus inter se appressis; receptaculum conicum ca 3–4 mm altum, basi 1.5 mm latum, phyllariis post anthesin rotatis, demum deciduis.

JALISCO: Mountain plateau ca 6–7 km E of Tapalpa; springy meadows in pine zone, elev. 2200 m, 3 Nov 1960, *McVaugh 20687* (MICH, type). Otherwise unknown.

This species is so similar in almost every respect to other species of *Jaegeria* that there can be little doubt of its relationship to that genus. On technical characters, however, most formal arrangements of the Compositae would exclude it from *Jaegeria* because the ray-flowers are usually sterile, and place it near *Sclerocarpus* or *Aldama,* to which it seems to have little real affinity. Evidently the corky thickening of the pales throughout the head of *J. sterilis* is secondary evolutionary specialization. The pales of the outermost row of flowers (only), are similarly indurated and involute in *J. pedunculata* Hook. & Arn.

Montanoa andersonii McVaugh, sp. nov.

Frutex procerus, saepe arborescens, 4–7-metralis, caulibus 3–4 cm crassis, ramis in siccitate acute multistriatis, pilis appressis rufidulis vel brunneo-albis molliter pubescentibus; partes juniores tomentosae, coactae; pedunculi phyllariaque dense pubescentia vel pilosa; folia supra atroviridia, per pilos vix vel haud asperata, subtus pallida copioseque resinoso-globulifera, in venorum majorum axillis pilis longis grossis sed fragilibus incoloribus barbata, venis venulisque rare pubescentibus; folia principalia late ovata vel rhomboideo-ovata, triplinervia, 8–15 cm longa, 5–12 cm lata, acuminata, basi late rotundata vel abrupte angustata (marginibus fere rectis sub angulo 90° vel minore convenientibus), vel basi extrema cuneata vel paullo prolongata, subauriculata; petioli 2–6 cm longi, graciles, non marginati; margines obscure denticulatae cetera integrae vel sinuatae, vel foliorum majorum sublobatae, pari dentium deltoideorum vel acuminatorum supra medium munitae, angulisque basalibus acutis vel acuminatis; surculorum sterilium folia ovato-orbicularia, 10–20 cm longa lataque, petiolis 4–7 cm longis, laminis hexagonis (angulo terminali longiore), vel majoribus palmatim 3–5-lobatis, lobis terminalibus quadratis, a lobis lateralibus oblongis 6–8 cm longis sinubus rotundis separatis, auriculis ad 1 cm longis apice petioli instructis; folia inflorescentiae ovata vel lanceolata, 2–5 cm longa, integra vel obscure denticulata; inflorescentia composita terminalis paniculiformis, paniculis secondariis 10–15 (–25) cm longis, ramis majoribus oppositis, capitulis 10–25 in fasciculis alternatim ramosis aggregatis, pedunculis 3–10 (–20) mm longis; capitula 4–6 cm lata (radiis extensis mensa), statu fructifero 1.5 (–2?) cm lata; involucrum sub-biseriatum, hemisphericum vel demum phyllariis rotatis vel laxe reflexis; phyllaria propria 3–6, subaequalia, elliptica vel ovato-lanceolata, obtusa vel breviacuta, pilis appressis pubescentia, 3–5 mm longa, 1–1.5 mm lata; bracteae seriei interioris ca 3–6, inter phyllaria et paleas intermediae, quam phyllaria longiores, angustiores, laxius pilosae, longius acutae; flores radii ca 8, ligulis albis oblongo-ellipticis obtusis, 2–3 cm longis, 4–6 mm latis, extus rare pubescentibus et resinoso-globuliferis; flores disci ca 55, corollis flavidis 6–7 mm longis, tubo rare piloso 1.5 mm longo, fauce anguste campanulata, basi sensim angustata, distaliter dense brevipilosa, lobis ovatis acutis pilosis 1.3 mm longis; antherae glabrae atropurpureae 2.3–2.5 mm longae, basi acute auriculatae, appendicibus ovatis acutis eglandulosis 0.5–0.7 mm longis; styli ramuli 1.5 mm longi, lineares, ad apices truncato-cuspidatos praecipue dense papillosi; glandula crassa styli basin cingens; pappus nullus, sed corollae basis subpersistens, glandulam stylarem involvens et ad achaenii apicem interdum annulum formans; achaenia 2–2.5 mm longa, glabra laeviaque, nigrescentia, compressa, biconvexa vel pyramidalia, ad basin attenuata, apice truncata; paleae sub anthesi attenuatae, quam corollae disci dimidio breviores, dorso longipiloso et glandulares, sub

finem anthesis rigidae cartilagineae, folliculiformes, dorso carinatae, corpore 2–3 mm longo, marginibus interioribus achaenium involventibus sed non connatis, apice acuminato arista erecta lineari-subulata 3–4 mm longa munito; paleae statu fructifero coriaceae, rigidae, 6–8 mm longae conduplicatae, corpore (statu plicato) 1.5–2 mm lato, apice subulato canaliculato saepe corpus subaequanti.

Species discipulo adjutorique William Russell Anderson (1942-), qui mecum plantas mexicanas anno 1965 collectavit, dedicavi.

FIG. 29. *Montanoa andersonii* (*McVaugh 13849*, type). Flowering branch, X ½; ray-corolla, X 1; disk-corolla, pale at late anthesis (left), and over-mature fruiting pale, X 5; over-mature fruiting head, X 2; anthers, immature achene with stylar gland, and mature achene with persistent corolla-base, X 7.5. Entire leaf from *Anderson & Laskowski 3814;* lobed leaf of vigorous shoot from *Anderson & Laskowski 3824.*

This species is unusual in that the disk-corollas remain attached to the achenes, sometimes even until the latter mature and fall from the head. The small, narrow, rigid-tipped pales are unlike those of any other species in Nueva Galicia. In the other large-flowered species with which *M. andersonii* might be confused, the tips of the fruiting pales are much shorter than the body.

JALISCO: Sierra de Manantlán, 30–35 km SE of Autlán, on steep slopes near summits, in pine-oak forest, 2100–2450 m, 29 Sep 1966, *Anderson & Laskowski 3812, 3814, 3815, 3822, 3824;* same locality, elev. 2500 m, 2 Nov 1952, *McVaugh 13849* (MICH, type).

MICHOACAN: Coalcomán, Sierra Torrecillas, elev. 2500 m, 19 Dec 1938, *Hinton 12794;* pine-fir forests near summits ca 25 km SW of Dos Aguas, nearly W of Aguililla, elev. 2400–2500 m, 6 Mar 1965, *McVaugh 22828.*

Montanoa laskowskii McVaugh, sp. nov.

Frutex procerus 3–5-metralis, asperato-pubescens, caulibus teretibus glabrescentibus, ramulis pedunculisque arcte pilis appressis asperatulis; folia supra pilis rigidis conicis e discis pallidis erumpentibus valde asperata, subtus minute resinoso-globulifera, bullata (venulis reticulatis impressis), venis rare pilosis; phyllaria pilis arcte appressis pubescentia; folia ovata vel ovato-trilobata (surculorum palmatim 3–5-partita), triplinervia, 8–15 cm longa, 6–10 (–15) cm lata, apice (et loborum apicibus) anguste acuminatis vel subcaudatis, marginibus denticulatis vel dentatis vel sublobatis, lobis utroque latere 1 (raro 2) ascendentibus triangularibus vel prolongatis lobulatisque; laminae infra medium rotundatae, basi interdum late alatae prolongatae subamplexicaules, majores saltem plerumque ad petioli 0.5–2 cm longi apicem auriculatae, lobisque paucis (1–3) bene separatis variis e petioli marginibus oriundis instructae; inflorescentiae folia plerumque ovata, dentata, 2–4 cm lata; capitula pauciuscula (ad 20–30), in paniculis latis laxe ramosis disposita, ramis majoribus ad 25 cm longis oppositis, ramulis minoribus alternis, pedunculis nudis 2–6 cm longis; capitula 4–5.5 cm lata (radiis extensis mensa), statu fructifero 2.5–3 cm lata; involucrum inconspicuum, phyllariis radiantibus vel laxe reflexis 9–10, planis, elliptico-lanceolatis, obtusis subacutisve, 4–5.5 mm longis, 1.3–2 mm latis; phyllaria interiora in paleis transientia, pro parte cuspidata, radios arcte subtendentia, parte obtusa, paleis inter flores et bracteas interjacentibus; flores radii 8–13, albi, ligulis 1.5–2.5 cm longis, 5–12 mm latis, obovatis, obtusis, extus glandulari-puberulentibus et resinoso-globuliferis; flores disci 65–100, corollis flavidis 7–8 mm longis, subcylindricis, sursum paullo ampliatis, basi excepta dense papilloso-pubescentibus, tubo 0.7–1 mm longo, basi dilatato, fauce longa basi rotundata vel subtruncata, lobis ovatis acutis, 0.6–1 mm longis; antherae glabrae, 2 mm longae, basi acute auriculatae, appendicibus acutis sagittatis coriaceis 0.8 mm longis; styli ramuli 1.5 mm longi, cuspidato-acuminati, infra apices angustos fimbriati; achaenia glabra laeviaque nigrescentia epapposa, turbinato-quadrangularia, 3.2–4.5 mm longa, apice truncato 2 mm lata, corollae cicatrix 0.5–0.8 mm lata, margine integra vel ca 4-dentata; paleae sub anthesi membranaceae, costa pilosa, corpore ciliato obovato, truncato, quam achaenio immaturo multo longiore et id involventi, sed marginibus haud vel vix connatis, cuspide erecta floribus delapsis manifesta; paleae statu fructifero 10–11 mm longae, papyraceae, retusae, conduplicatae, aspectu laterali obovatae 3–5 mm latae, margine exteriore (plicata) rectiore, lobis apicalibus rotundatis erosis 1–2 mm altis, aristis rigidis 1–2 mm longis, basi planis 0.3–0.5 mm latis, lobis aequantibus vel paullo superantibus; receptaculum conicum, ut videtur glabrum, paleis longe persistentibus.

Species in honorem dixi Chester Walter Laskowski (1941–), amici discipulique, qui mecum humanissime generis *Montanoae* plantas siccas plurimas communicavit.

Among the large-headed species of *Montanoa* having the pales retuse, with a short erect awn between the apical lobes, *M. laskowskii* is closest to *M. pyramidata* K. Koch, a common and widely distributed species of the Pacific Slope of western Mexico. The two may be distinguished as follows:

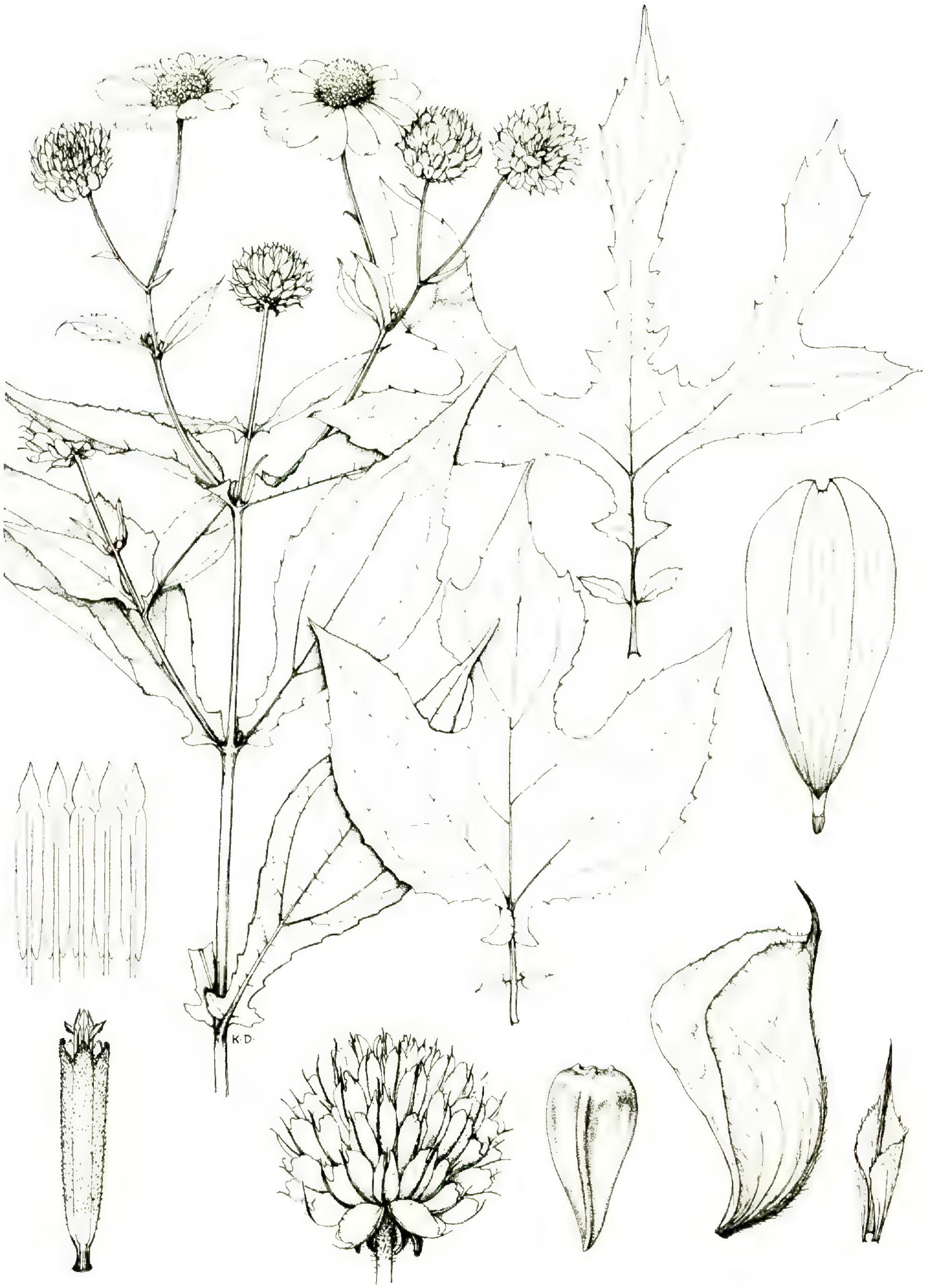

FIG. 30. *Montanoa laskowskii* (*McVaugh 18053*). Flowering and fruiting branch, X ½; slightly immature fruiting head, X 1.5; ray-corolla, X 2; disk-corolla, X 4; achene, immature and mature pales, X 5; anthers, X 10. Detached leaves from *Anderson & Laskowski 3777B* (above), and *Anderson & Laskowski 3777A* (type, below).

1. Leaves 20–50 (–75) cm long, deeply pinnately divided, with 3–5 lobes on each side; petioles 5–10 cm long, irregularly wing-margined above and often with additional lobes below; disk-flowers 150 or more; fruiting pales 12–15 mm long, the cusp 0.6–1.2 mm long. *M. pyramidata.*
1. Leaves 8–15 cm long, at most with one pair of long lobes, usually not lobed or but obscurely so; petioles 2 cm long or less, not winged but often biauriculate at the summit and with small separate lobes below; disk-flowers 65–100; fruiting pales 10–11 mm long, the cusp 1–2 mm long. *M. laskowskii.*

Specimens examined:

JALISCO: Between La Huerta and Barra de Navidad, mountain slopes in deciduous forest within sight of the ocean, elev. less than 570 m, 26 Sep 1966, *Anderson & Laskowski 3777A* (MICH, type, in flower), 3777B (sterile, with deeply 3-lobed leaves), *3777C* (with half-grown pales); same locality, same plant, 16 Dec 1966, *Anderson & Laskowski 4543* (with mature pales).

COLIMA: Low mountains in deciduous forest, in gypsum area ca 17–18 km SSW of Colima, elev. 500 m, 21 Sep 1958, *McVaugh 18053.*

Otopappus jaliscensis McVaugh, sp. nov.

Frutex debilis vel herba lignosa ramosa diffusa, 2–3-metralis, caulibus basi ad 1–2 cm crassis; partes vegetativae pilis pallidis arcte appressis 0.2–0.5 mm longis strigosae, folia supra scabridula, pilis paullo longioribus rigidis obliquis obsita; folia ramique oppositi vel summi alterni; folia ovata vel ovato-lanceolata, triplinervia, (5–) 8–18 cm longa, 2–4 (–7) cm lata, 2.5–3-plo longiora quam latiora, apice acuta vel anguste sensimque acuminata, versus basin rotundata marginibusque inde cuneatim decurrentibus, petioli parte nuda 3–10 mm longa; laminae supra basin cuneatam non profunde dentatae, dentibus utroque latere (5–) 15–25; rami prope apices 1–5-plo furcati, capitulis solitariis vel ternis, pedunculis crassis 0.5–6 cm longis, 1–2 mm crassis; capitula 3–5 cm lata (radiis extensis mensa); involucrum hemisphericum vel late campanulatum, 8–13 mm altum, ad 1.5 cm latum, 3–4-seriatum, phyllariis ca 25, exterioribus gradatim brevioribus; phyllaria exteriora (5–8) foliacea, rigida, obtusa, 7–10 mm longa, 4–7 mm lata, apicibus laxe patentibus vel reflexis; phyllaria interiora obovata vel oblanceolata, scariosa, 6–9 mm longa, 3–6 mm lata, obtusa, basi coriacea, apicibus latis, membranaceis, erosis, viridibus vel purpurascentibus; flores radii 12–15, feminei fertilesque, ligulis aureis, oblanceolatis, 12–18 mm longis, 3–5 mm latis, tubo 3–6 mm longo; styli 5–7.5 mm exserti, ramulis 2–3.5 mm longis; flores disci aurei 30–60, corollis 10–11 mm longis, tubo gracili 3 mm longo, fauce subcylindrica, lobis 5 acutis pubescentibus 1.1–1.5 mm longis; antherae nigrescentes 3–3.5 mm longae basi auriculatae, angulis pallidis, appendicibus pallidis acutis lanceolatis 0.8 mm longis; styli ramuli ca 3 mm longi, attenuati, facie interiore papillosi, exteriore antrorse hispidi; achaenia 4–5 mm longa compressa, disci bialata (ala adaxiali multo latiore) et biaristata, radii 3-alata et 3-aristata, aristis planis, ad 4 mm longis, 1 mm latis, in achaenii alis decurrentibus, arista interiore plerumque multo majore; squamellae 0.5–1.5 mm longae, inter aristas in quoque intervallo 1–2, vel saepe cum aristis continuae; paleae 10–12 mm longae, coriaceae, basi conduplicata 6–8 mm longa, plicata 1.5 mm lata, et apice rigido lineari 4–5.5 mm longo, 0.3–0.5 mm lato.

JALISCO: 3 km above (N of) La Cuesta, road to Talpa de Allende, tropical deciduous forest, elev. 800 m, 19 Nov 1960, *McVaugh 21166* (MICH, type); 8–12 km above La Cuesta, elev. 1200–1500 m, 22 Nov 1960, *McVaugh 21277;* mountains above Ahuacapán, 20–25 km SSE of Autlán, in pine forest, elev. 1500–2200 m, 22–23 Nov 1959, *McVaugh & Koelz 900, 956.*

This differs from the species of *Otopappus* known to me in the very broad tips of the inner phyllaries, the large heads with relatively few phyllaries, the large flowers, long pales with linear tips 4–5.5 mm long, and pappus-squamellae 0.5–1.5 mm long.

Otopappus koelzii McVaugh, sp. nov.

Frutex debilis ad arbores se inclinans, 3–10-metralis scandens, ramis florentibus pendentibus, caulibus basi ad 2 cm crassis, ramis divaricatis oppositis, vel inflorescentiae ramulis alternis; partes vegetativae pilis pallidis arcte appressis 0.2–0.5 mm

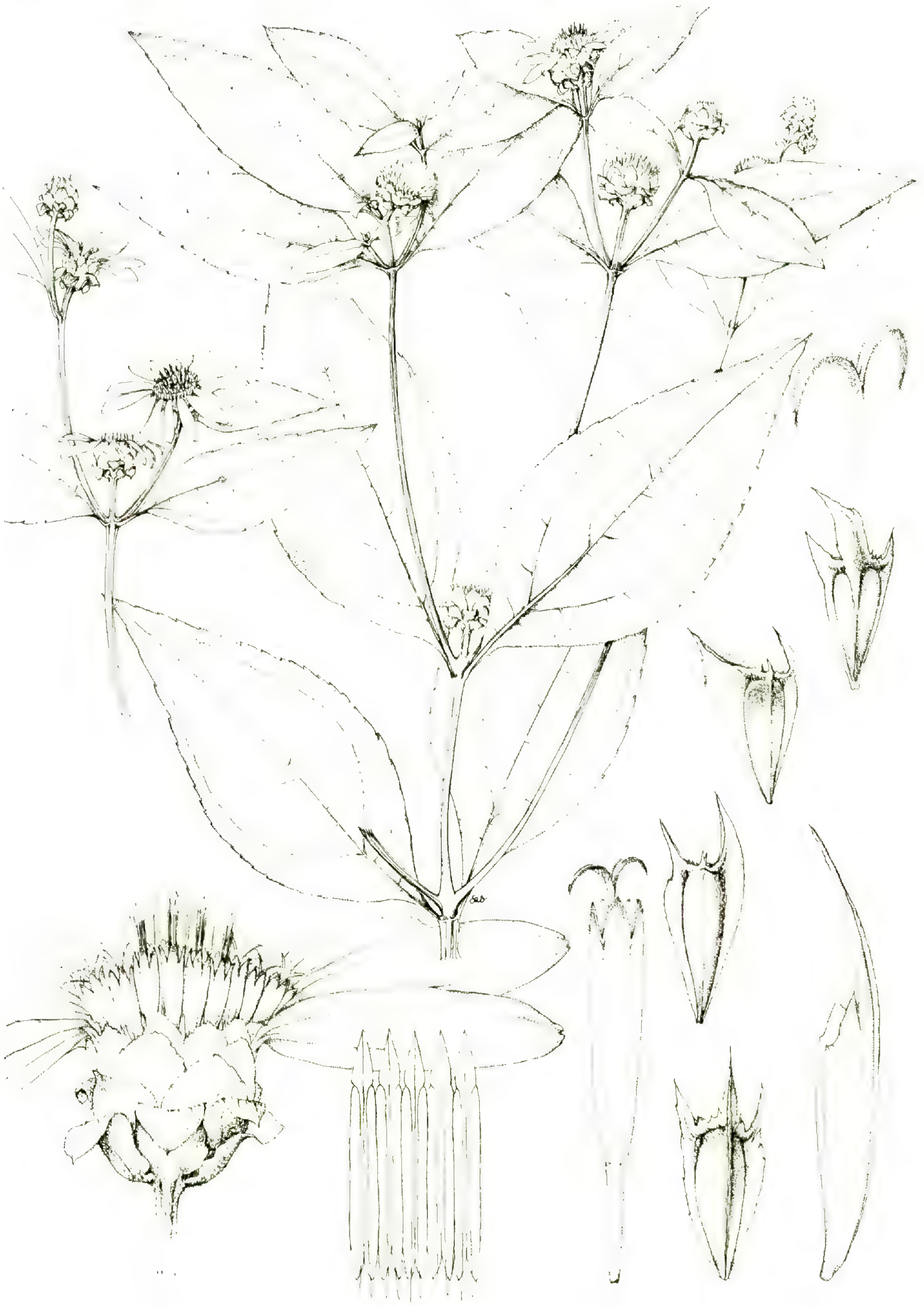

FIG. 31. *Otopappus jaliscensis.* Flowering branch, X ½; flowering head, X 2; disk-corolla and achenes (2 at bottom, ray-achene lowermost), X 5; anthers and style-tips, X 7.5 (all from the type, *McVaugh 21166*). Pale, X 5 (*McVaugh & Koelz 900*). Achenes (2 at right center, ray-achene at far right, X 5 (*McVaugh & Koelz 956*).

FIG. 32. *Otopappus koelzii* (*Feddema 2729A*, type). Flowering branch, X ½; flowering head, X 2; disk-corolla, disk-achene, ray-achene (right), and pale, X 5; anthers and style-tips, X 10.

longis strigosae; folia opposita, rigida, supra ad tactum asperula sed nec scabra nec rugosa, triplinervia, nervis lateralibus validis arcuatis ultra laminae medium productis, ad margines plusminusve parallelis; laminae lanceolatae vel majores ovatae, apice sensim longe acuminatae, marginibus utroque latere dentibus 10–20 non profunde serrulatis, basi rotundatis et plerumque in petiolos (0.5–) 1–2.5 cm longos subdecurrentibus; folia caulinia (tempore florendi saepe delapsa) 15–18 cm longa, 6–8.5 cm lata; folia ramealia 5–12 cm longa, 1.5–4 cm lata; capitula pauca in inflorescentiis paniculiformibus subnudis parvibracteatis, ramis divaricatis brevibus rigidis, capitulis solitariis vel ternis, terminalibus vel ramis lateralibus suffultis, pedunculis 1–5 cm longis, 1–2 mm crassis; capitula 4.5–6 cm latis (radiis extensis mensa), 10–15 mm alta, involucro hemispherico vel latiore, basi rotundato vel centro impresso, 7–10 mm alto, tempore florendi 1–2 cm lato, ca 4–seriato; phyllaria ca 50–60, exteriora gradatim breviora; phyllaria exteriora 20 vel ultra, 5–8 mm longa, corpore ovato vel lanceolato apicibusque dilatatis viridibus squarrosis, ovatis vel ellipticis vel suborbicularibus; phyllaris intima tot quot flores radii, coriacea, scariosa, oblanceolata vel linearia, 6–9 mm longa, 1.5–2 mm lata, apicibus brevibus obtusis firmis vel corrugatis; flores radii ca 13–21, feminei fertilesque, aurei, ligulis anguste elliptico-lanceolatis, 15–18 mm longis, 2–3 mm latis, subtus crebre resinoso-globuliferis, tubo 2.5 mm longo; flores disci ca 60–100, aurei, corollis 6–7 mm longis, basi glabris, tubo gracili 2–2.5 mm longo, fauce subcylindrica versus apicem paullo ampliata, lobis 5 triangularibus 1 mm longis, intus papillosis; antherae brunneae, 2.2–2.7 mm longae, angulis pallidis, basi auriculatae, appendicibus acutis triangularibus 0.6–0.8 mm longis; styli ramuli lineares 2–3 mm longi, applanati, abrupte acuti, facie abaxiali strigosi; achaenia 4.5–5.5 mm longa, 1–3-aristata, inaequaliter 1–3-alata, aristis alatis decurrentibusque; achaenia disci lateraliter compressa, biconvexa, quaque facie 2–3-acutinervata, 1–2-aristata, 1–2-alata, arista adaxiali quam altera longiore latioreque, ad 3 mm longa, 2 mm lata; achaenia radii 2-angulata, ala aristaque adaxiali majore, aristis abaxialibus 2 brevibus et anguste alatis vel valde reductis; squamellae nullae vel coronam minutam scariosam erosam formantes; paleae rigidae, 9–10 mm longae, conduplicatae carinataeque, plicatae ca 1 mm latae, apicibus attenuatis anguste triangularibus 1.5 mm longis.

Species in honorem dixi amici Walter Norman Koelz (1895–), residentis michiganensis, olim Asiae exploratoris peritissimi.

In Blake's revision of *Notoptera* and *Otopappus* (Jour. Bot. Brit. & For. 53: 202, 225–235. 1915), he distinguished the genera on the basis of the pappus only. In *Otopappus* this structure consists of two unequal and unequally winged awns, and some more or less connate intervening squamellae. In *Notoptera* the squamellae are wanting. This distinction appears to be a specious one. In the *Flora Novo-Galiciana* all the species of this alliance are referred to *Otopappus,* as in most species forms with and without squamellae may be found. In *Otopappus koelzii* the squamellae are often wanting, as in the somewhat similar species, *O. epaleaceus* Hemsl., with which it is contrasted below:

1. Leaves rugose and very scabrous above, the lower surface bristly with short erect hairs especially on the veins; ligules 5–8 mm long; disk-corollas 4.5–5 mm long; western Michoacán (east of our limits) to Guerrero. *O. epaleaceus.*
1. Leaves essentially flat and but slightly rough above, strigose on both surfaces with very closely appressed hairs; ligules 15–18 mm long; disk-corollas 6–7 mm long; southeastern Jalisco, Colima, and western coastal Michoacán. *O. koelzii.*

Specimens of *O. koelzii* examined:

JALISCO: On limestone, steep forested hills with *Brosimum,* ca 12–13 km SW of Pihuamo, elev. 500–600 m, 6 Dec 1959, *McVaugh & Koelz 1518.*

COLIMA: On gypsum and slate, low mountains in deciduous forest 17–18 km SSW of Colima, elev. 400–500 m, 25 Nov 1959, *McVaugh & Koelz 1066.*

MICHOACAN: Aquila, elev. 200 m, 28 Nov 1941, *Hinton 16046;* Cruz de Campo, 10 km SE of Aquila, in deciduous forest on karstic limestone, elev. ca 50 m, 24 Nov 1963, *Feddema 2729A* (MICH, type).

Otopappus tequilanus (A. Gray) Rob., var. **griseus** McVaugh, var. nov.

Folia supra atroviridia, rugulosa, subtus argentea, pilis rigidis appressis dense aggregatis, pilisque gossypinis obsita; laminae ovato-lanceolatae, 2.5–5-plo longiores quam latiores; inflorescentia argentea, pilis arcte appressis ut videtur coactis; phyllaria 25–35, intima elliptico-obovata apicibus tenuibus obtusis erosisque, vel subobtusis apiculatis; flores radii 9–13, ligulis 5–7 mm longis; flores disci 50–55.

NAYARIT: 8 km N of Compostela, wooded valley of Río Miravalles, elev. 900 m, 13–14 Nov 1959, *McVaugh & Koelz 640* (MICH, type); 8–10 km W of Mazatán, tropical deciduous forest with *Brosimum,* elev. 350–400 m, 17 Sep 1960, *McVaugh 19095;* mountainsides above La Cucaracha, 24–27 km S of Las Varas, high forest with *Orbignya* and *Brosimum,* elev. 300–350 m, 19–20 Sep 1960, *McVaugh 19244.*

JALISCO: River valley 3 km N of Las Palmas, forest with *Brosimum,* elev. 150 m, 19 Dec 1970, *McVaugh 25547;* 3 km SE of Puerto Vallarta, subdeciduous forest along Río Cuale, elev. 50 m, 12 Nov 1963, *Feddema 2511.*

The var. *tequilanus* differs from var. *griseus* in having the leaves green beneath, the ray-flowers 15–21, and the ligules 4–5 mm long. It is a plant primarily of the inland river-valleys of the Pacific slope of Mexico from Nayarit to Guerrero.

All known collections of var. *griseus* bear on the lower leaf-surface the fruiting bodies (1–2 mm wide) of a gill-fungus tentatively identified as *Marasmius* sp. The fungus hyphae occur at least in part as thin cottony layers on the leaf, and may indeed make the surface appear paler than it otherwise would. The silvery color of the inflorescence, however, seems to derive chiefly from the thickly matted hairs of the plant itself.

Pectis decemcarinata McVaugh, sp. nov.

Annua, prostrata vel suberecta, ad 30 cm alta vel 50 cm lata, ramis flexuosis ad 25–28 cm longis e nodis infimis oriundis; caules inferne, superneque saltem in lineis duabus, pilis pallidis flaccidis multicellularibus obsiti; folia supra subaspera, hispida, subtus crebre glandulis rotundis obsita, fere glabra, marginibus prope basin nervoque medio pilis instructis; pedunculi phyllariaque glabra (*Hinton 12090* excepta); folia coriacea uninervia sessilia, summis exceptis lineari-elliptica vel oblanceolata, (1.5–) 2.5–5 cm longa, (1.5–) 3–7 mm lata, distaliter attenuata vel abrupte angustata, apicibus obtusis vel breve apiculatis; laminae versus bases dilatatas, paullo scariosas, vaginantes angustatae, multo infra medium paribus setarum 3–7, ad 3 mm longarum, munitae; capitula quoque ramo pauca vel ad 20, subsessilia in glomerulis terminalibus conferta; glomeruli foliis 4–6 lanceolatis fasciculum involucriforme formantibus suffulti superatique; capitula campanulata, radiis erectis vel patentibus inclusis 6–7 mm longa, omnino sessilia vel pedunculis subulato-bracteatis ad 2–4 mm longis suffulta; involucrum 4.5–5 mm longum, ad basin angustam truncatam attenuatum, distaliter ampliatum, tum sub apice constrictum; phyllaria subaequalia 5, elliptico-oblonga vel -obovata, late obtusa vel subacuta, tenuimarginata, 1.3–1.8 mm lata, maturitate basi aliquantum conduplicata, dorso obtuse 2–3-porcata, apicibus appressis vel subpatentibus; involucrum ut videtur 8–10-porcatum, phyllariorum carinis suberosis torulosis, centralibus basi non gibbis, versus apices productis, lateralibus solum in phyllariorum marginibus exterioribus prodientibus, phyllariis plusminusve connatis, capitula e receptaculo integra decidua; flores flavi, in siccitate non rubescentes, manifeste exserti, florum disci partes exsertae quam involucrum plus quam dimidio breviores; flores radii plerumque 5, ligulis 2–2.5 mm longis, 0.7–1.2 mm latis, ellipticis vel obovatis; styli ramuli laeves, 0.7–1 mm longi; flores disci 9–10, corollis tubuloso-campanulatis 3 mm longis, lobo solitario lineari-attenuato 1.5–1.8 mm separato, lobis 4 oppositis 0.5–0.7 mm longis; antherae ca 1.5 mm longae, basi auriculatae, appendicibus tenuibus

brevibus, obtusis; styli glanduloso-hispidi, truncati, vix lobati; achaenia disci matura non visa, verisimiliter sterilia; achaenia radii 3 mm longa, nigrescentia, clavato-columnaria, striata, molliter pilosa; pappi squamellae inaequales ca 10, subulatae vel oblongae, hyalinae, 0.5–2 mm longae, apicibus capilliformibus; receptaculum sub-convexum 0.5–0.6 mm latum.

MICHOACAN: Tepalcatepec, elev. 400 m, 24 Aug 1938, *Hinton 12090;* thorn forest on low hills between San Juan de los Plátanos and Amatlán, Mpio. de Buenavista, elev. 275 m, 17 Sep 1958, *McVaugh 17967* (MICH, type); 8 km SW of Nueva Italia, 15 Aug 1961, *Feddema 1722.*

In Nueva Galicia the only species with which this might be confused is *Pectis prostrata* Cav., in which the involucre is 5-keeled, the disk-flowers 4–5, the pappus-

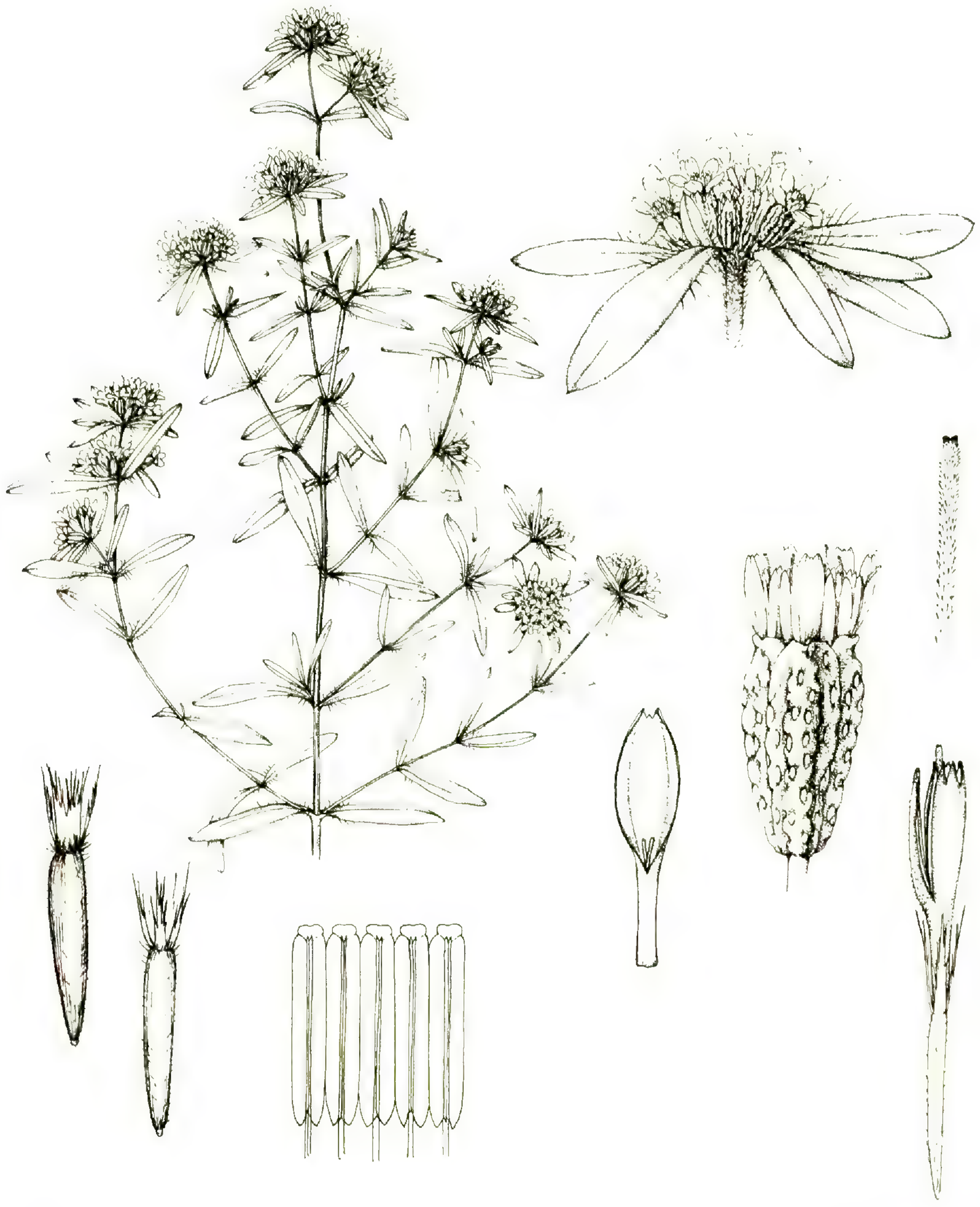

FIG. 33. *Pectis decemcarinata* (*McVaugh 17967,* type). Flowering branch, X ½; involucrate cluster of heads, ca X 1.5; flowering head, X 5; ray-corolla and achenes, X 7.5; disk-corolla with abortive achene, X 10; anthers and style, X 15.

scales usually 2 in the ray-flowers, 5 in the disk. In *P. decemcarinata* the sessile heads, in glomerules subtended by involucre-like clusters of leaves, are distinctive.

Pectis exserta McVaugh, sp. nov.

Annua, debilis, diffusa, 30 cm alta, ramis pedunculisque purpurascentibus, hispidulis; folia prope basin obscure ciliata, nervo medio subtus et marginibus asperis, cetera glabra; phyllaria glabra; folia subcoriacea, subtus glandulis rotundis 1–2-seriatis manifeste obsita, fere linearia, ad basin apicemque paullo angustata, 1.5–2.5 cm longa (ramorum breviora), 1–2.5 mm lata, obtusa apiculataque vel superiora acuta apiceque breviaristata, omnia uninervia, prope basin paribus 1–3 setarum debilium 1–2 mm longarum munita; rami repetite furcati, internodiis brevibus, capitulis plurimis, laxe subumbellatis, pedunculis erectis sed gracilibus subulato-bracteatis 1–2 cm longis; capitula radiis inclusis 8–9 mm longa; involucrum ca 4 mm longum, junius campanulatum, demum urceolatum, sub apice constrictum, basi 5-lobatum, truncatum; phyllaria subaequalia 5, elliptico-oblonga vel -obovata, late obtusa vel apice rotundata, pallide viridia, 1.3–1.8 mm lata, tenuimarginata, maturitate aliquantum conduplicata, obtuse carinata, apicibus tenuibus appressis, ciliatis, plerumque glandulosis; carina suberosa indurata, phyllarii tota longitudine apice excepto producta, basi gibba prolongata; flores aurei manifeste exserti, florum disci partes exsertae quam involucrum quarta parte breviores; flores radii plerumque 5, patentes, ligulis ellipticis, 3–4 mm longis, 1.3 mm latis, interdum in siccitate extus rubescentibus; styli ramuli laeves, 1 mm longi; flores disci 12–17, corollis 3–3.7 mm longis, anguste tubulosis, lobo solitario anguste lineari 1.5–2 mm separato, lobis 4 oppositis incurvatis, glanduloso-incrassatis, 0.25 mm longis; antherae 1.7 mm longae, subauriculatae, appendicibus tenuibus obtusis brevissimis; styli ramuli glanduloso-hispiduli, brevissime bifidi, apicibus oblongis obtusis 0.15 mm longis; achaenia nigrescentia, lineari-clavata, 2.5–2.8 mm longa, striata, pilosa; pappi squamellae ovato-triangulares vel lanceolatae 0.3–0.6 mm longae, erosae, acutae vel apicibus capilliformibus, disci florum inaequales ca 5, radii deminutae ex pari aristarum dorso-lateralium constantes, vel aristam tertiam minorem abaxialem includentes; receptaculum convexum, 0.5 mm latum, breve glanduloso-pubescens, phyllariorum cicatricibus profundis lateralibus.

JALISCO: Tropical subdeciduous forest 8 km WSW of Cihuatlán, with *Orbignya*, elev. ca 100 m, 7 Nov 1960, *McVaugh 20807* (MICH, type). Otherwise unknown.

In the account of *Pectis* in the *North American Flora* (vol. 34, p. 195. 1916) this would seem to be identified with *P. propetes* Greenm., a little known species of northern Jalisco. In *P. exserta*, however, the involucre is 6–7 mm long, campanulate, not constricted distally, the phyllaries are moderately keeled near the base (only), and the pappus is 0.8–1.5 or 2 mm long.

Perityle feddemae McVaugh, sp. nov.

Suffrutex caulibus florentibus plurimis basi excepta herbaceis ramosis 10–25 cm altis, e caudice lignoso 1 cm crasso corticato oriundis, inferne subglabris; rami superiores, pedunculi, folia involucraque sparsiuscule pilis brevibus, pallidis appressis vel crispatis pubescentia; partes vegetativae (praecipue folia) crebre globulis resinosis impressis obsitae; folia principalia (et inferiora) opposita (ramorum superiorum plerumque alterna), petiolo 7–12 mm longo incluso 2–3.5 cm longa; laminae in ambitu late ovatae, subternatim semel aut bis in segmentis oblongis vel cuneato-oblanceolatis obtusis dissectae, segmentis 1–8 mm longis, 0.5–2 mm latis, rhachide 0.3–0.8 mm lata; capitula ca 5–6 mm alta, compressa 5–7 mm lata, ad apicem caulis et in axillis summis solitaria, pedunculis 5–17 mm longis; involucrum hemisphaericum vel late campanulatum, obscure biseriatum; phyllaria 15–18, subaequalia, 4–5 mm longa, 0.8–1.3 mm lata, elliptico-oblanceolata, acuta, apicibus tenuibus, basi gibba obtuseque carinata; flores radii nulli; flores disci 30–40, corollis flavidulis 2.5 mm longis, stipitato-glandularibus, tubo quam fauce anguste campanulata breviora, lobis 4 triangularibus

FIG. 34. *Pectis exserta* (*McVaugh 20807,* type). Flowering branch, X ½; flowering head, X 6.5; cauline leaf, X 5; ray-corolla, X 6; disk-corolla, X 7.5; achenes, X 10; anthers, X 15; style-tips, X 20.

0.5 mm longis, apicibus extus resinoso-globuliferis; antherae 4 subauriculatae, appendicibus ovatis obtusis inclusis 1.3 mm longae; styli ramuli applanati 1 mm longi, apicibus recurvatis obtusis vel acutis, papillosis; achaenia nigrescentia, compressa, ambitu oblanceolato-oblonga, 2.2–2.9 mm longa, ca 0.5–0.8 mm lata, marginibus crassis albis callosis appresse strigosa, faciebus pilis bifurcatis paucis instructis; pappus ex aristis subaequalibus 2, rigide erectis, marginalibus 0.7–1.2 mm longis, coronaque lacerata 0.2 mm longa constans; receptaculum convexum 1.7–2 mm latum, vetustate lucens, phyllariis valde reflexis circumcinctum, cicatricibus achaeniorum paullo impressis.

Species in honorem dixi discipuli nunc collegae Charles Feddema (1920–), qui Compositarum generis *Sclerocarpi* revisionem egregiam elaboravit.

JALISCO: Rancho Viejo, ca 10 km ENE of Huejuquilla el Alto, rock-crevices, open oak-woodland, elev. 1900 m, 31 Oct 1963, *Feddema 2278* (MICH, type).

Of the known rock- or cliff-dwelling species of *Perityle,* this appears to be the only one with dissected leaves and discoid heads.

Perymenium alticola McVaugh, sp. nov.

Herba grandis basi lignosa, vel frutex inflorescentia excepta subsimplex, caulibus 2–3-metralibus, basi ad 1.5–2 cm crassis; partes vegetativae per pilos breves, rigidos appressos asperatae, pilis longioribus ad 0.6 mm longis; folia triplinervia, lanceolato-

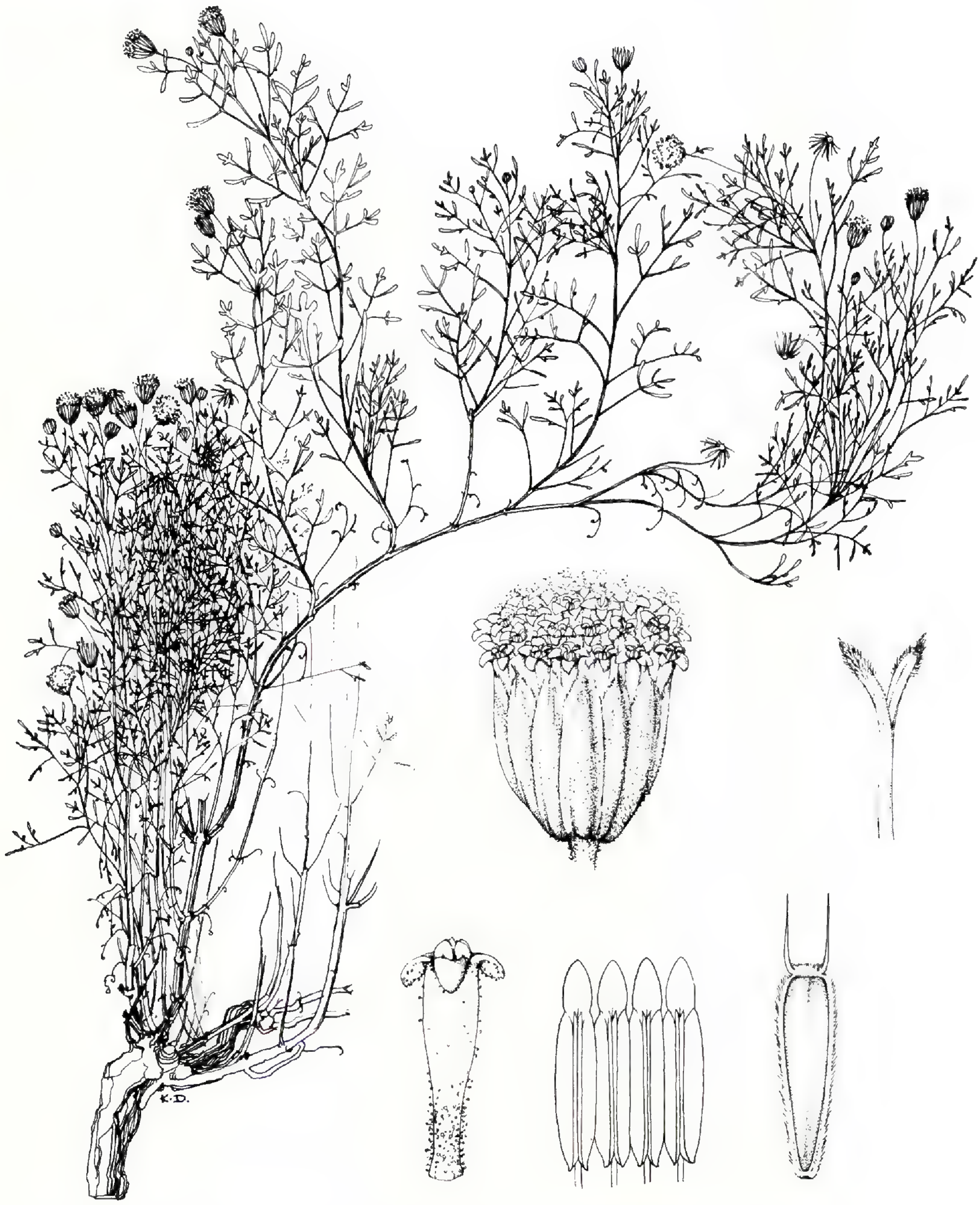

FIG. 35. *Perityle feddemae* (*Feddema 2278,* type). Flowering and fruiting plant, ca X 3/5; flowering head, X6; achene, X 9; disk-corolla and style-branches, X 12; anthers X 20.

ovata, 6–14 cm longa (ramorum minorum florentium 3–5 cm longa), (1–) 2–4.5 cm lata, 2.5–4-plo longiora quam latiora, apice sensim longe acuminata vel attenuata, basi rotundata, petiolis 3–7 (vel 8–23) mm longis, marginibus dentibus utroque latere 7–15 non profunde remotiusculeque denticulatis; capitula pauca, terminalia axillariaque ad ramorum apices in fasciculis corymbiformibus, pedunculis plerumque ternis vel quinis 1.5–6 cm longis, e nodo folioso terminali oriundis, interdum pedunculorum axillarium vel ramorum brevium foliosorum alia insuper pari vel paribus e nodis proximis; capitula 2.5–3.5 cm lata (radiis extensis mensa), sub anthesi 12–15 mm alta; involucrum campanulatum, 8–10 mm altum, basi rotundatum, ca 2–3 seriatum; phyllaria ca 13, exteriora breviora ca 5 (interdum bracteis pedunculi 1–2 arcte

suffulta), ovata, 4–6.5 mm longa, 2.5–5 mm lata, herbacea vel purpurascentia, apicibus crassis obtusis vel acutis; phyllaria interiora (radios subtendentia) subaequilonga, 8–10 mm longa, 2–3.5 mm lata, ovata vel elliptica vel obovata, vel intima late linearia, apicibus tenuioribus (interdum membranaceis), subacutis vel obtusis, erosis; flores radii ca 8, ligulis aureis 1–1.5 cm longis, 3.5–4.5 mm latis, oblongis, tubo 2.5 mm longo; styli ramuli 1.5 mm longi; flores disci ca 20–30, corollis aureis 6.5–9 mm longis, tubo 2–3.5 mm longo, fauce anguste campanulata, lobis anguste triangularibus acutis hispidis 1–2 mm longis; antherae 2.3–3.2 mm longae, atrobrunneae, appendicibus pallidis acutis 0.7–1 mm longis; styli ramuli lineares 1.3–2 mm longi, intus applanati, apicibus acutis extus pilosis; achaenia disci biconvexa 3.5–4.5 mm longa, 1.3–1.7 mm lata, versus apicem in collum breve pappum ferens rotundata; pappi aristae setiformes 25–30, duabus marginalibus exceptis 1–2 (–3) mm longae (interior 3–4.5 mm longa, exterior paullo brevior); achaenia radii similia sed plano-convexa vel trigona, pappo ut in achaeniis disci, una arista (adaxiali) longiore, vel ad angulos aristis 3 quam ceteris longioribus; paleae 8–12 mm longae, conduplicatae carinataeque, membranaceae, apicibus acutis, flavidis vel nigrescentibus, saepe corrugatis.

JALISCO: 25–30 km SE of Autlán, steep rocky summits in mountains between El Chante and Cuzalapa, in pine forest, elev. 2000–2250 m, 19–22 Mar 1965, *McVaugh 23173* (MICH, type); Nevado de Colima, southeastern slopes, in fir forest, elev. 2850 m, 2 Apr 1951, *McVaugh 11712, 11712A*. Otherwise unknown.

In the collections from the Nevado de Colima the heads are fewer, and darker in drying, with longer pales, longer flowers, and more rigid, herbaceous and pubescent phyllaries, than in the type. The significance of these differences is unknown. It is possible that two species are included here under the one name.

This is one of the few species of *Perymenium* having large heads and relatively long petioles. It appears to be distinct from all other Mexican species, but I cannot suggest what its affinities within the genus may be.

Perymenium buphthalmoides DC. in DC. Prodr. 5: 609. 1836.

The highly variable complex that includes *Perymenium buphthalmoides* was treated by Robinson and Greenman, and later by Blake, as a group of 4 or 5 species distinguished by leaf-shape, by the shape of the phyllaries and by differences in pubescence. Blake described *P. simulans* as having a "well developed pappus," and Greenman similarly characterized *P. flexuosum* as having a "reduced" pappus. None of these characters seems to be satisfactory as a criterion of taxonomic difference. Many individual specimens are intermediate in one respect or another, and the different populations are not very satisfactorily separated, but in Nueva Galicia their ranges seem not to overlap to any great extent. Var. *tenellum* is a plant primarily of grasslands and their margins from Durango to San Luis Potosí; var. *buphthalmoides* occurs in the relatively dry, open montane forests, especially in the Sierra Volcánica Transversal; var. *flexuosum* is apparently restricted to the higher mountains between the region of Mexico City and Cerro Tancítaro; and var. *occidentale* is a plant of relatively humid forests of the mountains and valleys of the Pacific slope in Nueva Galicia.

1. Paleae 5.5–7 mm longae, flexibiles, apicibus angustis attenuatis 1.5–3.5 mm longis; pubescentia relative tenuis, appressa, pilis phyllariorum venorumque foliarium majoribus 0.5 mm longis vel brevioribus; achaenia 3–3.5 mm longa. var. *occidentale*.
1. Paleae 3.5–5 mm longae, apicibus rigidis, breviacutis, plerumque purpurascentibus, vel cum paleis 6.5–8 mm longis; plantae grosse pilosae, pilis plusminusve patentibus ad 1 mm longis vel longioribus.
   2. Paleae 3.5–5 mm longae, rigidae, plerumque purpurascentes, apicibus triangularibus vel deltoideo-acuminatis 0.5–2 mm longis; in montibus Sierra Volcánica Transversal dictis, et in montibus propinquis.
      3. Folia caulinia manifeste ovata, saepe petiolis 3–6 mm longis suffulta, dentibus 0.5–1.5 mm altis serrata vel crenato-serrata; paleae purpurascentes; achaenia 2–2.5 mm longa; pedunculus, et plerumque involucri basis, pilis ascendentibus vel

patentibus copiose obsita; ab urbe Mexico ad civ. Michoacán partem occ. distributa, 2500–3000 m.s.m. var. *flexuosum.*

3. Folia caulinia elliptica, lanceolata vel ovato-lanceolata, subsessilia (raro ovata petiolataque), denticulata vel serrata, dentibus saepe brevibus remotiusculisque; paleae flavidae vel purpurascentes; achaenia 2.5–3 mm longa; pedunculus involucrumque appresse saepeque sparsiuscule pilosum; a Nayarit ad Oaxacam, elev. 2000–2500 m.s.m. var. *buphthalmoides.*

2. Paleae 6.5–8.5 mm longae, rigidae vel paullo flexuosae, flavidae vel purpurascentes, apicibus angustis attenuatis 2–3 mm longis; pubescentia pro maxima parte grossa, pilis caulium venarumque foliarium majoribus ad 1 mm longis vel longioribus, plusminusve patentibus; a Durango ad San Luis Potosí. var. *tenellum.*

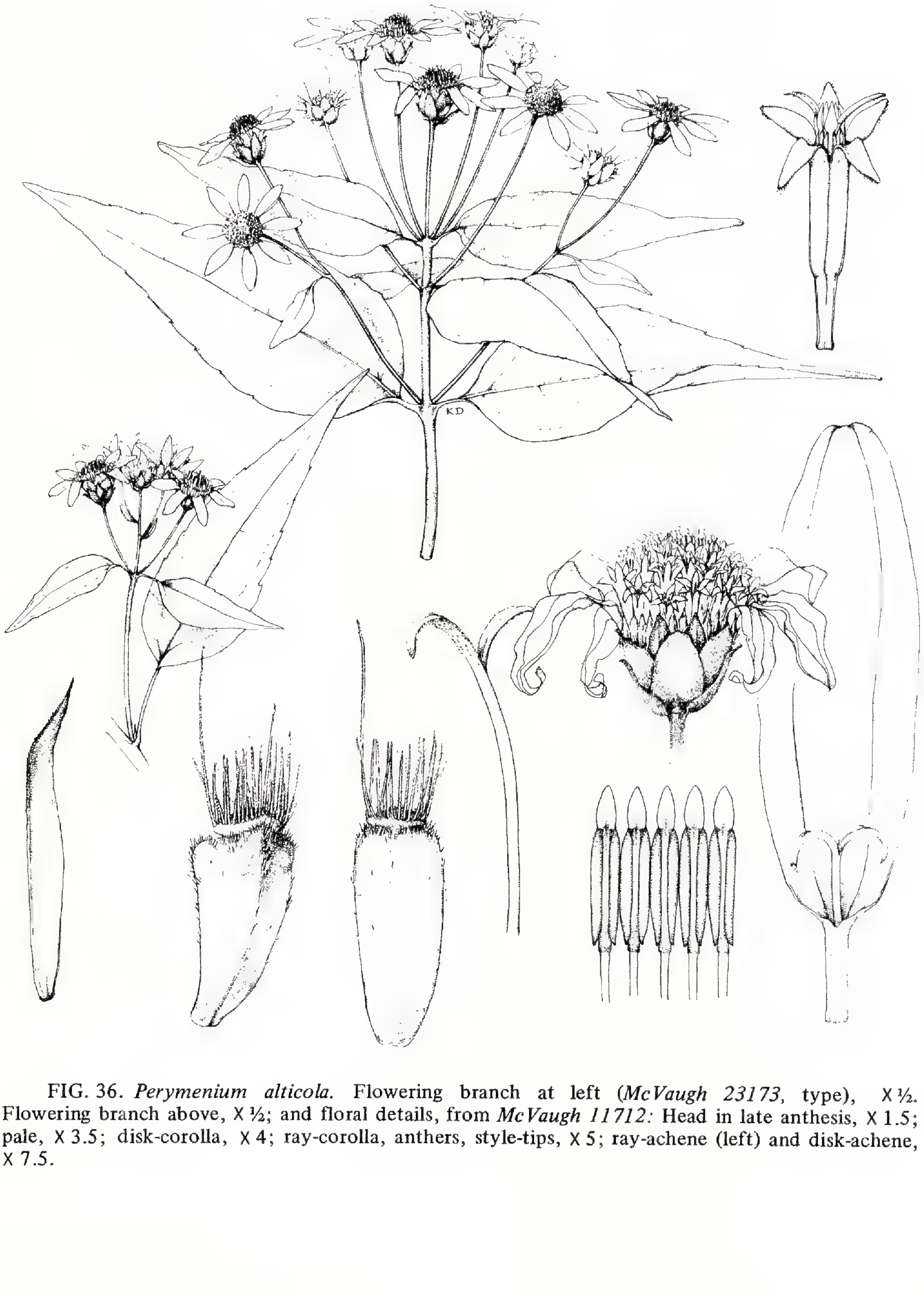

FIG. 36. *Perymenium alticola.* Flowering branch at left (*McVaugh 23173*, type), X ½. Flowering branch above, X ½; and floral details, from *McVaugh 11712:* Head in late anthesis, X 1.5; pale, X 3.5; disk-corolla, X 4; ray-corolla, anthers, style-tips, X 5; ray-achene (left) and disk-achene, X 7.5.

Perymenium buphthalmoides DC., var. **flexuosum** (Greenm.) McVaugh, comb. nov. *Perymenium flexuosum* Greenm. Proc. Am. Acad. 41: 263. 1905.

Perymenium buphthalmoides DC., var. **tenellum** (A. Gray) McVaugh, comb. nov. *Perymenium tenellum* A. Gray, Proc. Am. Acad. 15: 36. 1879. *Perymenium simulans* Blake, Contr. U.S. Nat. Herb. 22: 621. 1924.

Perymenium buphthalmoides DC., var. **occidentale** McVaugh, var. nov.
Specimens of var. *occidentale* examined:

NAYARIT: Open oak woodland, mountains 16 km SE of Ahuacatlán, elev. 1100–1300 m, 7 Jul 1957, *McVaugh 15147.*

JALISCO: Forested mountainsides above La Resolana, highway to Autlán, 300 m elev., 6 Jul 1949, *Wilbur & Wilbur 1548;* 1050 m elev., 9 Jul 1949, *Wilbur & Wilbur 1606;* near Guadalajara [Río Blanco], 7 Aug 1902, *Pringle 8624* (US); LaPalma, 9 Jun 1892, *M.E. Jones 283* (US); Tecalitlán, Sierra del Halo, in pine forest, elev. 2000 m, 15 Aug 1957, *McVaugh 16218;* Tecalitlán, Puente San Pedro, in oak-pine forest, 1200 m, 16 Jul 1957, *McVaugh 15439* (MICH, type).

MICHOACAN: Coalcomán, Sierra Torrecillas, elev. 2350 m, 25 Jul 1939, *Hinton 13997* (US).

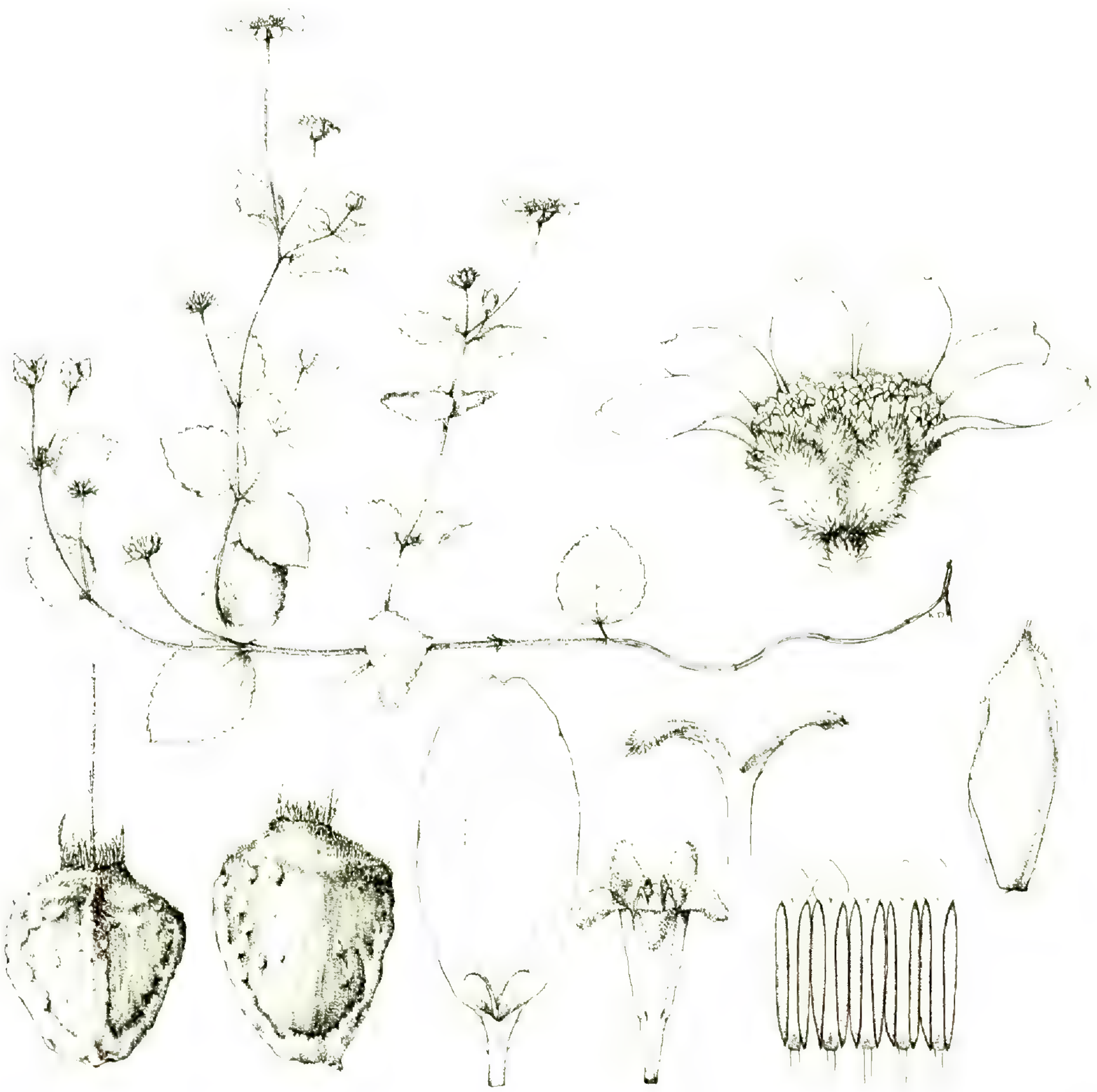

FIG. 37. *Perymenium diguetii* (*Diguet s.n.*, type). Flowering and fruiting branch, X ½; flowering head with two rays removed, X 2.5; ray-corolla, X 5; disk-corolla, and pale, X 7.5; ray-achene (left), disk-achene, and anthers, X 10; style-branches, X 15.

Perymenium diguetii McVaugh, sp. nov.

Herba decumbens vel subascendens, caulibus paucis ramosis 20–40 cm longis, 1–2 mm crassis, e caudice lignoso oriundis; partes vegetativae rigide pilis patentibus vel ascendentibus 0.5–1.5 mm longis obsitae; caules hirsutuli; folii involucrique pilis crassis ascendentibus; folia ovata, 1–2.8 cm longa, 0.5–2.2 cm lata, 1–1.5-plo longiora quam latiora, apice obtusa vel subacuta, basi rotundata vel subcordata, petiolis 1–2 mm longis, marginibus utroque latere dentibus 6–12 grosse crenato-serratis; caules 4–7-nodi, in capitulo pedunculato terminantes, pedunculo terminali 2–7.5 cm longo, plerumque ramis foliosis ex eodem nodo axillaribus superato, ramis capitulo solitario terminali vel 1–3-plo furcatis et capitula pedunculata pauca producentibus; capitula 1.5–2.5 cm lata (radiis extensis mensa); involucrum hemisphericum vel latius; phyllaria subaequalia, quam radii vix plura et eos plerumque subtendentia, 3.7–5.5 mm longa, 1.5–2.7 mm lata, oblongo-elliptica vel ovata, apicibus crassis herbaceis, acutis vel rotundatis, basi pallidiora, rigida; flores radii 7–11, ligulis aureis, oblongo-obovatis, ca 6–8 mm longis, 3–4 mm latis; styli ramuli ca 1 mm longi; flores disci 25–40, corollis 3.7 mm longis, tubo angusto 1–1.5 mm longo, fauce lutea subcylindrica vel campanulata, et lobis aureis triangularibus breve hispidis 0.7 mm longis; antherae 1.5 mm longae, nigrescentes connectivis pallidis, basi auriculatae, appendicibus rigidis cochleariformibus 0.5 mm longis; styli ramuli prope apices dilatati, applanati, penicillati; achaenia disci 2.2–2.5 mm longa, 1.3–1.8 mm lata; achaenia radii 2.2 mm longa, latere abaxiali 2 mm lata; pappus ex arista adaxiali setiformi rigida 1.8–2.2 mm longa, antrorse barbellata, caduca, aristisque gracilioribus 2–10 deciduis 0.2–0.5 mm longis constans; paleae 3–4 mm longae, rigidae, saepe purpurascentes, apice abrupte acuto vel late triangulari 1–1.5 mm longo.

Species alteram Léon Diguet (1859–1926), in honorem dicavi.

NAYARIT: Sierra del Nayarit, partie occidentale, *Diguet* (MICH, type; P); in the Sierra Madre near Santa Teresa, 8 Aug 1897, *Rose 3313* (US); between Santa Gertrudis and Santa Teresa, 8 Aug 1897, *Rose 2077* (US).

This species is evidently closely related to *Perymenium buphthalmoides* DC., but in that species the ligules are often 1–2 cm long, the phyllaries are usually more than 5 mm long, the leaves are usually twice as long as wide, or longer, and with acute teeth, and the stems are simple, or with terminal and axillary peduncles from the terminal node, seldom with leafy branches that greatly surpass the central peduncle.

Perymenium hintonii McVaugh, sp. nov.

Frutex procerus vel arborescens 3–4-metralis, copiose ramosus; partes vegetativae strigosae, asperulae, pilis pro maxima parte brevissimis, appressis, pilis longioribus ad nodis et in foliis (praecipue subtus in venis) ad 0.8–1.3 mm longis; phyllaria strigosa et conspicue ciliata; folia ovata, 3-nervata, 5–7 cm longa (vel ramorum minorum florentium 2.5–4.5 cm longa), (1–) 2–4 cm lata, apice acuta vel acuminata, basi rotundata, petiolis 3–8 mm longis, marginibus non profunde serratis vel denticulatis; inflorescentia bene evoluta subcorymbosa, ramis divaricatis 10–25 cm longis, ascendentibus, ramulis ultimis interdum alternis parvibracteatis, capitulis subirregulariter dispositis, solitariis vel binis vel ternis, pedunculis 1–4 cm longis; capitula ca 2.5–3 cm lata (radiis extensis mensa), sub anthesi 9–12 mm alta; involucrum campanulatum (statu fructifero hemisphericum), 7–9 mm altum, basi late rotundata 4–6 mm crassum, 2–3-seriatum; phyllaria ca 13–16, exteriora gradatim breviora, 5–7, sterilia, ciliata, ovata, suborbicularia vel late elliptica, 3–7 mm longa, 2.5–5 mm lata, apicibus crassis sed vix herbaceis, obtusis vel rotundatis; phyllaria interiora (achaenia subtendentia) 6–9 mm longa, late elliptica vel obovata, late obtusa vel acuta, 4–5 mm lata (vel intima angustiora, in paleas transientia), apicibus membranaceis pallide viridibus flavidulisve, subpetaloideis, fimbriatis, ciliis 0.4–0.8 mm longis; flores radii ca 7–9, ligulis aureis 1 cm longis, 3 mm latis, tubo 1.5–2.5 mm longo; styli ramuli 1.5 mm longi; flores disci ca 16–20, corollis aureis 7–8.8 mm longis, tubo 1.5–2 mm longo,

fauce cylindro-campanulata, lobis acutis anguste triangularibus 1–1.4 mm longis; antherae brunneae 2–2.5 mm longae, appendicibus anguste ovatis acutis 0.8–1 mm longis; styli ramuli 1.7–2.3 mm longi, apicibus pilosis, longe attenuatis, subulatis; achaenia disci biconvexa, 3.3–4.7 mm longa, apice truncato 1.6–2 mm lata, in angulis duobus interdum dente erecto piloso 0.8–1 mm longo munita; pappus ex aristis setiformibus 20–30 in corona breve centrali dispositis constans, aristis minoribus 0.7–2 mm longis vel 1–2 longioribus, interiore (adaxiali) quam ceteris crassiore longioreque, 2.6–4.5 mm longa; achaenia radii similia, trigona, interdum in angulis brevidentata; pappi aristi 1 vel 3 longiores, ceteris brevioribus; paleae membranaceae, carinatae, 5–7 mm longae, apicibus inflexis subacutis flavidulis.

Species George Boole Hinton (1883–1943), plantarum mexicanarum collectori indefesso, nominavi.

MICHOACAN: Mpio. Apatzingán, Acahuato, elev. 740 m, 17 Aug 1938, *Hinton 12045* (MICH, type); above Acahuato, pine forest, elev. 960 m, 17 Aug 1941, *Leavenworth & Hoogstraal 1660.*

MEXICO: Temascaltepec, Naranjo, 8 Oct 1935, *Hinton 8534.* Otherwise unknown.

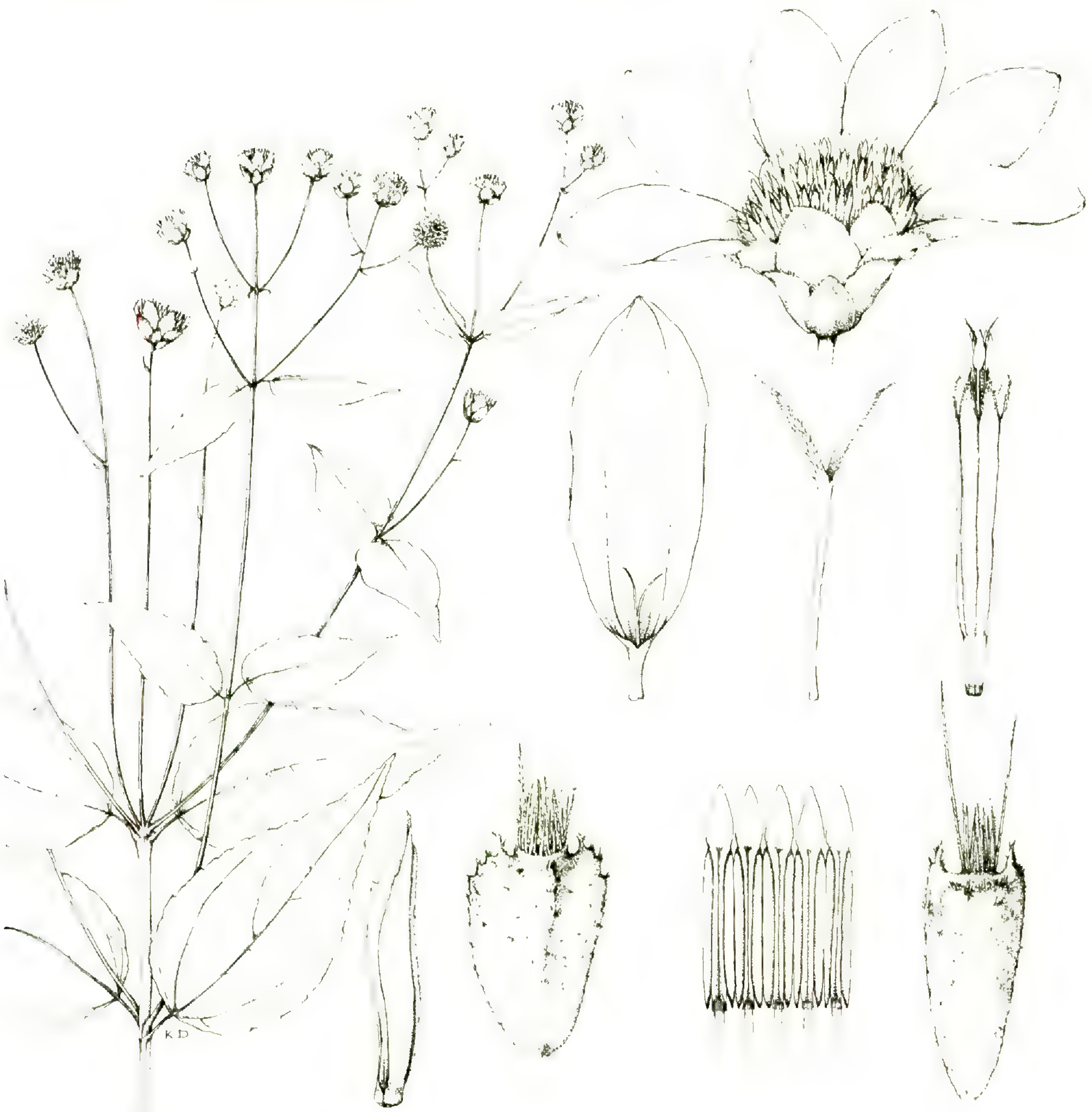

FIG. 38. *Perymenium hintonii* (*Hinton 12045,* type). Fruiting branch, X ½; flowering head, X 2.5; ray-corolla, ca X 4; disk-corolla, pale, ray-achene (left), disk-achene, X 5; anthers and style-tips, X 7.5.

Superficially this species somewhat suggests *Perymenium pringlei* Rob. & Greenm., but the heads, flowers, and achenes are larger than in that species, the petioles are shorter, and the leaves in *P. hintonii* are somewhat bullate beneath. From *P. verbesinoides* DC. the new species differs in having the phyllaries mostly obtuse and the inner phyllaries with broad ciliate tips, the leaves flat (not rugulose), the disk flowers 16–20 (not 25–35).

Perymenium jaliscense Rob. & Greenm., var. **latifolium** McVaugh, var. nov.

A var. *jaliscensi* foliis latioribus ovatis 2.2–2.4 cm latis, petiolis 4–8 mm longis, ligulis radii 10–14 mm longis differt.

NAYARIT: Cerro Sangangüey, ca 17–18 km SE of Tepic, open oak woodlands, elev. 1600–1800 m, 24 Aug 1959, *Feddema 927, p.p., 937.*

JALISCO: Mpio. de Tecalitlán, Sierra de los Corales, pine-oak forest, elev. 1600 m, 24 Oct 1963, *Rzedowski 17415* (MICH, type).

The var. *jaliscense* is little known except from the original collections by Palmer (1886) and Pringle (1903). It seems strange that it has not been found again near the type-locality, somewhere in the vicinity of Guadalajara. The leaves are elliptic to lance-ovate, 0.8–1.7 cm wide, the petioles 1.5–4 mm long, and the ligules probably 6–8 mm long.

Perymenium uxoris McVaugh, sp. nov.

Frutex erectus multiramosus ligno duro, ramis foliisque omnino oppositis; rami angulis 4 obtusis sulcisque interjacentibus, pilis brevissimis pallidis appressis strigosi, ramuli hornotini pedunculique interdum pilis dealbati; folia utrinque asperata, subtus in venis pilis rigidis papillosis attenuatis instructa; phyllaria pilis 0.2–0.4 mm longis fimbriato-ciliata, cetero subglabra vel pilis paucis prope apices; folia siccata rigida, lanceolata vel ovato-lanceolata, 5–10 cm longa, 0.8–3.5 cm lata, 3–5-plo longiora quam latiora, apice acuta, basi rotundata vel acuta, petiolis 5–12 mm longis; laminae penniveniae, venis utroque latere 4–6 valde arcuato-ascendentibus, marginibus paullo incrassatis revolutisque, utroque latere dentibus 6–15 denticulatis vel crenatis; inflorescentiae corymbosae, ramorum majorum foliosorum 15–25 cm latae, ramulis secundariis in paribus 3–6 dispositis, ascendentibus, 10–25 cm longis, capitulis plurimis, ad ramorum apicibus in cymis parvis confertis, sessilibus vel pedunculis 1–2 mm longis suffultis, plerumque per folia superiora superatis; bracteae cymarum 5–8 mm longae; capitula florentia anguste turbinata, 8–11 mm alta, 2.5–3.5 mm lata (1–1.5 cm lata radiis extensis mensa); involucrum 5–7.5 mm altum, biseriatum; phyllaria ca 10, subaequalia vel exteriora omnia vel ex parte paullo breviora angustioraque, omnia elliptico-oblonga vel -oblanceolata, basi coriacea, apicibus obtusis, membranaceis vel papyraceis (extima interdum apicibus brevibus viridibus); phyllaria interiora (radios subtendentia) 1.3–2 mm lata, ad basin plerumque angustata, apicibus membranaceis 2–3 mm longis; flores radii vulgo 5, ligulis aureis, erectis vel subpatentibus, ellipticis, 5 mm longis, 1.5 mm latis, tubo gracillimo 2.5–3 mm longo; styli ramuli 1.5 mm longi; flores disci 8–10, corollis aureis 4–5 mm longis, tubo cylindrico 1.5–1.7 mm longo, in faucem campanulatam abruptiuscule ampliato, lobis triangularibus hispidulis 0.6–0.8 mm longis; antherae flavo-brunneae 2 mm longae, basi auriculatae, appendicibus ovatis coriaceis 0.5 mm longis; styli ramuli 1.7 mm longi; achaenia nigrescentia 3–3.5 mm longa, compressa, ambitu elliptica vel elliptico-obovata (disci biconvexa crassa, radii plerumque angulo interiore instructa), distaliter marginibusque strigosa, supra medium marginibus subalatis, laciniatis, alis in aristas planas ad 1 mm longas et basi 0.7 mm latas productis; aristae pappi ca 30, 0.5–2 mm longae; paleae membranaceae 4–5 mm longae, 1.5 mm latae, conduplicatae, carina angusta minute ciliata, apicibus brevibus acutis, erosis.

Species uxori carissimae Ruth Lillian Beall, quae mecum in peregrinationibus multis per terram mexicanam libenter perlustravit, grate nominavi.

TYPE: NAYARIT: On deep eroding sandy soils in oak-savannah region 6–8 km E of Las Varas, on the new road to Compostela, elev. 200 m., 20 Dec 1970, *McVaugh 25583* (MICH). Known only from the type-locality.

Among the shrubby species of *Perymenium* in Nueva Galicia, this one and *P. wilburorum* are unique in having green and moderately long-petioled leaves, heads numerous in leafy inflorescences, and the phyllaries all narrow and elongate, subequal, the involucre not graduate. I have not located any previously published names pertaining to these taxa, but it is possible that they represent isolated populations of species already known from eastern Mexico or Central America.

FIG. 39. *Perymenium uxoris* (*McVaugh 25583,* type). Flowering branch, X ½; flowering head, X 2.5; corollas, disk-achene (left), ray-achene, pale, X 5; anthers and style, X 10.

Perymenium wilburorum McVaugh, sp. nov.

Frutex gracilis copiose ramosus 1.5–3-metralis, pilis rigidis appressis vel ascendentibus omnino asperatus; folia supra pilis attenuatis basi crassis scabra, subtus resinoso-globulifera pilisque mollioribus gracilioribusque crebre obsita vel fere tecta, venis pilosis, pilis rigidioribus; folia triplinervia, lanceolato-ovata, 4–9 cm longa, 1–3 cm lata, 2.5–3.5-plo longiora quam latiora, sensim longe acuminata, basi rotundata vel subcordata, marginibus revolutis, manifeste vel obscure denticulatis, basi in petiolos 5–10 mm longos cuneatim decurrentibus; capitula 3–4 cm lata (radiis extensis mensa), sub anthesi 10–13 mm alta, ad ramorum apicibus terminalia axillariaque, saepe ad nodis terminalibus terna, vel e nodo subterminali pedunculorum axillarium vel ramorum brevium foliosorum florentium pari oriundo; involucrum late campanulatum, apice pedunculi valde impressum; phyllaria 9–12, lanceolata, herbacea, vel basi gibba

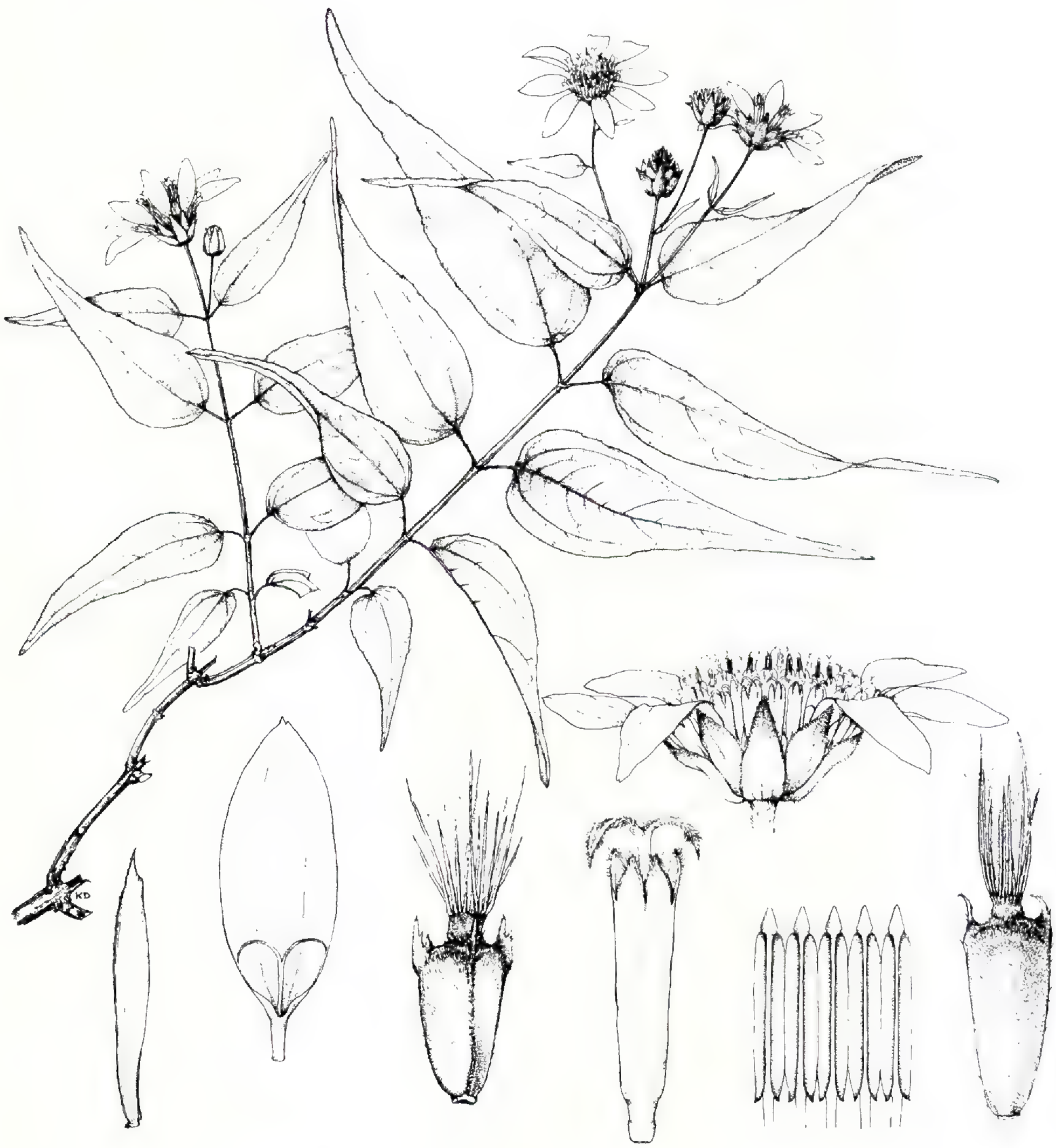

FIG. 40. *Perymenium wilburorum* (*Wilbur & Wilbur 1751*, type). Flowering branch, X ½; flowering head with one ray removed, X 1.5; ray-corolla, X 2.5; pale, disk-corolla, ray-achene (left), and disk-achene, X 5; anthers, X 7.5.

pallida rigidiusculaque, acuta vel subacuta, subaequalia (vel extima 1–3 intimaque 1–3 minora), majora radios plerumque subtendentia, 8–11 mm longa, 2.5–3.5 mm lata; flores radii 7–9, ligulis aureis 12–15 mm longis, oblongo-lanceolatis 4–5 mm latis, tubo 1–1.5 mm longo; styli ramuli 1.5–2.5 mm longi, apicibus attenuatis; flores disci ca 40, corollis aureis 6.5–7 mm longis, tubo 1.3 mm longo, fauce subcylindrica, lobis triangularibus hispidis, acutis; antherae brunneae, 2.2–2.5 mm longae, appendicibus acutis triangularibus 0.5–0.7 mm longis; styli ramuli 2 mm longi, adaxiale applanati, apicibus longe attenuatis acutis abaxiale pilosis; achaenia disci biconvexa, 3.3 mm longa, distaliter 1.5 mm lata, saltem angulo adaxiali prope apicem anguste alata, ala in arista alata 0.5 mm longa producta; apex achaenii rotundatus, corona cupuliformi 0.5 mm alta pappum ferentia superatus; achaenia radii 3-angulata, 1–3-alata, 1–3-aristata; pappus (disci) ex setis 2 grossis 3–4.5 mm longis (interiore paullo vel multo longiore), setisque 12–15 gracilioribus 0.5–2.5 mm longis constans; achaeniorum radii pappus similis, arista adaxiali ad 5 mm longa, plerumque quam ceteris multo majore crassioreque; paleae 6–7.5 mm longae, apicibus aristato-acuminatis, hispidulis.

Species in honorem fratrum Wilbur qui anno 1949 in civitate Jalisco plantas siccas pretiosissimas plurimas collectaverunt, dixi.

JALISCO: Interior valley, dry shrub-covered slopes 11–12 km S of Autlán, elev. 1050 m, 15 Jul 1949, *R. L. Wilbur & C. R. Wilbur 1751* (MICH, type); 3 km W of Autlán, 900 m, 13 Jul 1949, *Wilbur & Wilbur 1718.* Otherwise unknown.

For a note on the taxonomic position of this plant, see above under *Perymenium uxoris,* from which *P. wilburorum* may be distinguished by the much larger heads with more numerous flowers.

Porophyllum coloratum (H.B.K.) DC., var. **obtusifolium** (DC.) McVaugh, comb. nov. *Porophyllum obtusifolium* DC. in DC. Prodr. 5: 650. 1836.

Rydberg, in the *North American Flora,* treated *Porophyllum coloratum, P. obtusifolium,* and *P. seemannii* Sch. Bip. as three independent species, distinguishing *P. obtusifolium* on the basis of its pale flowers and obtuse leaves; the other species, with "Corollas more or less purple" and leaves "acute," were distinguished by the habit, *P. coloratum* being described as annual and *P. seemannii* perennial. In fact there appear to be two taxa only. After examination of the types of all three of the above names, I conclude that those of *P. seemannii* and *P. coloratum* represent the same taxon, and that of *P. obtusifolium* another. The two are moderately well separated by the characters in the following key, but scarcely merit recognition as distinct species:

1. Plants annual, diffusely branched, the peduncles (2–) 3–5 (–7) cm long; involucre usually pale but purple-spotted before anthesis; flowers purple; leaves usually with evident division into blade and petiole. *P. coloratum* var. *coloratum.*
1. Plants perennial, or flowering the first year, erect, with stiff short ascending branches, the peduncles 1–2.5 cm long; involucres seldom spotted, usually uniformly purple from the first; flowers purple or greenish white; leaves sessile or tapering to a petiolar base. *P. coloratum.* var. *obtusifolium.*

Porophyllum viridiflorum (H.B.K.) DC. in DC. Prodr. 5: 648. 1836. *Kleinia viridiflora* H.B.K. Nov. Gen. & Sp. 4: 157. 1820. *Porophyllum nutans* Rob. & Greenm. Proc. Am. Acad. 32: 31. 1896.

Since the publication in 1896 of a key to North American species of *Porophyllum,* by Robinson and Greenman, there has been some confusion about the identity of *P. viridiflorum* H.B.K. Recent authors have mostly applied the name *viridiflorum* to a species with thick and often strongly triplinerved leaves, more or less erect heads and 8–11 flowers in a head. This plant is correctly named *Porophyllum lindenii* Sch. Bip. The true *P. viridiflorum,* with membranous and pinnately veined leaves, nodding heads, and (as originally described by Kunth) 15–20 flowers in a head, is the plant known in recent works as *P. nutans* Rob. & Greenm. The type of *P. viridiflorum,* which I studied

in Paris in 1970, was collected near Morelia, Michoacán, in an area where *P. lindenii* seems not to have been discovered.

Schkuhria pinnata (Lam.) Cabrera, var. **guatemalensis** (Rydb.) McVaugh, comb. nov. *Tetracarpum guatemalense* Rydb. N. Am. Flora 34: 45. 1914. *Schkuhria anthemoidea* var. *guatemalensis* (Rydb.) Heiser, Ann. Missouri Bot. Gard. 32: 273. 1945.

As I interpret *Schkuhria pinnata* it is a widely distributed species, represented in South America by several taxa and in Nueva Galicia by two moderately well-separated varieties, *S. pinnata* var. *virgata* (Llave) Heiser, and var. *guatemalensis.* In his revision of *Schkuhria,* Heiser treated these taxa as belonging to two different species, but the differences between them are relatively insignificant (e.g. in color, in number of flowers in a head, in dimensions of flower parts, and in geographical range). In habit, and in most morphological details, they are indistinguishable.

Tithonia calva Sch. Bip., var. **lancifolia** (Rob. & Greenm.) McVaugh, comb. nov. *Gymnolomia calva* var. *lancifolia* Rob. & Greenm. Proc. Boston Soc. Nat. Hist. 29: 103. 1899. *Tithonia calva* [subsp.] *lancifolia* (Rob. & Greenm.) Blake, Contr. U.S. Nat. Herb. 20: 430. 1921.

Tithonia koelzii McVaugh, sp. nov.

Arbor laxe ramosa 6–7-metralis, trunco 1.5 m longo, diametro 15 cm, foliis ramisque alternis; partes vegetativae breve pubescentes, caulibus striatis pilis parum implexis contortisque arcte pallideque pubescentibus, pedunculis pilis longioribus erectioribus 0.5–1 mm longis sparsim obsitis; involucrum fere glabrum, phyllariis ciliatis, extimisque interdum breve hispidis; folia tenuia, utrinque viridia, supra pilis plurimis brevibus, arcuato-ascendentibus attenuatis asperata, subtus copiose pilosa, pilis mollioribus, gracilioribus 0.5 mm longis; laminae ovatae, non lobatae, 5–10 cm longae, 3–6 cm latae, acuminatae, basi rotundatae, marginibus non profunde crenato-denticulatis, non decurrentibus, petiolis gracilibus, 2–6 cm longis, basi auriculis parvis rotundatis herbaceis 2–5 mm latis instructis, distaliter abrupte dilatatis, venis majoribus separantibus et sub parte laminae foliacea prolongationem deltoideam formantibus; capitula ca 10 cm lata (radiis extensis mensa), ad apices ramulorum solitaria, pedunculis (4–) 6–10 cm longis, sub capitulis subinflatis, in locis latioribus 2–5 mm crassis; involucrum hemisphaericum, basi rotundatum, 1.5–1.8 cm altum, sub 2-seriatum; phyllaria 16–23, lata tenuiaque basi rigida multistriataque, apicibus patentibus pallide viridibus, tenuiter herbaceis; phyllaria exteriora (5–8) sterilia, 8–13 mm longa, 4–6 mm lata, anguste ovata vel obovata, acuta vel acuminata; phyllaria media interioraque (radios subtendentia) tenuiora longioraque, usque ad 2 cm longa et 1 cm lata, elliptica, obtusa, intimorum pauca interdum minora, in paleas transientia; flores radii 11–13, ligulis aureis, elliptico-oblanceolatis, 4–5 cm longis, 1.3–1.8 cm latis, tubo 2–3 mm longo, 1.5 mm crasso; styli plerumque manifesti sed ut videtur steriles, ramulis linearibus 2 mm longis, basi sulcatis, apicibus planis, obtusis, spatulatis; flores disci 150–200 vel ultra, corollis aureis 9–9.5 mm longis, tubo proprio crasso 1 mm longo, lobis 1.5 mm longis intus papillosis; antherae flavo-brunneae 4 mm longae, appendicibus ovato-lanceolatis 1 mm longis; styli ramuli 4 mm longi; achaenia disci biconvexa 6–7 mm longa, 2.2–2.7 mm lata, ambitu oblanceolata, tenuimarginata, marginibus appresse pilosis; pappus ex corona rigida, brunnea, erosa, lobulata vel bipartita 1.5–2 mm alta et ca 2 mm lata constans, aristis nullis vel duabus 0.5–0.7 mm longis, partium 2 coronae marginibus adherentibus; achaenia radii sterilia trigona, apice 3 mm lata, ad basin angustam attenuata, longitudine achaenia disci subaequantia, pappo lobato coroniformi 1.5 mm alto; paleae rigidae 8–11 mm longae, plicate 2.2 mm latae, anguste carinatae, emarginatae, apicibus subulato-aristatis 1.5–3.5 mm longis.

Species altera in honorem dixi amici et in terra mexicana comitis Walter Norman Koelz.

JALISCO: Steep rocky mountainsides, on limestone, 12–13 km SW of Pihuamo, in dense deciduous forest with *Plumeria, Ficus, Bursera, Louteridium, Verbesina furfuracea,* elev. 500–600 m, 6 Dec 1959, *McVaugh & Koelz 1504;* 15 Dec 1959, *McVaugh & Koelz 1795* (MICH, type); 19 Nov 1970, *McVaugh 24496*. Known only from the type-locality.

This appears to be a true *Tithonia* in every respect, except that the 2 pappus-awns are reduced to mere vestiges, and the ray-flowers have vestigial pistils and develop large but sterile achenes. The only other comparably arborescent species seems to be *T. fruticosa* Canby & Rose, in which the young herbage is densely and canescently long-pilose, and the petioles are broadly cuneately margined.

FIG. 41. *Tithonia koelzii* (*McVaugh & Koelz 1795,* type). Flowering branch, X ½; disk-corolla, pale, achenes, anthers and style-tips, X 5.

Verbesina cuautlensis McVaugh, sp. nov.

Herba perennis erecta tenuis, caulibus florentibus paucis 50–90 cm altis, basi 2–3 mm crassis, simplicibus vel supra ramis brevibus erectis instructis, e caudice crasso lignoso interdum ramoso, radices numerosas cordiformes ferenti, oriundis; rami inferiores interdum oppositi, ramorum alis 1–3 mm latis; rami superiores alterni, bracteas alternas angustas saepe ferentes, anguste alati, alis 0.1–0.5 mm latis vel pedunculis inter capitulum et bracteam summam nudis; partes vegetativae asperae, caulibus inferne glabris vel subglabris, involucro pedunculisque minute hispidulis; folis supra pilis erectis brevissimis conicis acutis e discis pallidis erumpentibus instructa, subtus viridissima, venis majoribus crassi- et paucipilosis, cetera glabra vel subglabra; folia caulinia opposita (foliorum paria ca 6–9), penninervia vel subtriplinervia, elliptica vel lanceolata (vel inferiora parva obtusa, ovata vel obovata), sessilia, 3–6 cm longa, 1–2.5 cm lata, apice obtusa vel subacuta, basi cuneata, marginibus denticulatis vel serratis, prope basin integris et in alas caulinas decurrentibus; capitula solitaria vel pauca, saepe ramis longis subnudis ultra folia multo productis suffulta, pedunculis propriis plerumque 1–6 cm longis; capitula florentia non visa, floribus verisimiliter aureis; capitula in statu fructifero 1–1.5 cm lata; involucrum breve campanulatum vel hemisphaericum, basi subtruncatum, 8–9 mm altum, ca 2-seriatum; phyllaria ca 16, exteriora ca 8, crassa, herbacea, oblonga vel spathulata 4–7 mm longa, 1.5–2.5 mm lata, apicibus laxe patentibus; phyllaria interiora (radios subtendentia) 7–9 mm longa, 1.5–2 mm lata, basi rigida, apicibus tenuibus, acutis vel subacutis, viridibus vel coloratis; flores radii ca 8 (–11?), steriles sed pistillo vestigiali et antheris parvis distinctis sterilibus instructi, ligulis ca 1.5 cm longis, 3 mm latis, tubo piloso 2 mm longo; flores disci 40–55, corollis ca 6.5 mm longis, tubo basi dilatato induratoque 1 mm longo, fauce subcylindrica, lobis acutis 1 mm longis; antherae nigrescentes 3 mm longae, appendicibus acutis ovatis 0.6 mm longis; styli ramuli ca 2.5 mm longi, apicibus angustis attenuatis; achaenia disci late obovata, alis inclusis 4.5–5.5 mm longa et 3.5–4.5 mm lata, corpore pallide brunneo 2.7–3 mm lato rare strigoso, alis ciliatis 0.5–1.2 mm latis, supra achaenium productis et ad bases aristarum 2 subaequalium 2.5–3.5 mm longarum adnatis; achaenia radii trigona 1.5–2.5 mm longa; paleae rigidae 8–10 mm longae, plicatae 1.5–1.8 mm latae, multo supra medium dentatae, apicibus tenuibus acutis interdum recurvatis 2–3 mm longis; receptaculum convexum 5–6 mm latum.

JALISCO: Road to Mascota, ca 10 km NW of Cuautla, grassy openings in oak forest, elev. 1850 m, 21 Oct 1952, *McVaugh 13655* (MICH, type); on the new road to Mascota, 6–8 km NW of Cuautla, 1700–1750 m, 9 Oct 1960, *McVaugh 19990*. Otherwise unknown.

In Nueva Galicia there are 9 known species of *Verbesina*, all upright nearly simple herbs with opposite leaves and winged stems, that may be contrasted as in the following key. Four of the species are described as new in this paper:

1. Heads large, mostly 1.5–2.5 cm across the disk; disk-flowers (75–) 100–200 or more; disk-corollas (6.5–) 8–11.5 mm long; rays neutral; peduncles, at least those terminating the branches, winged their whole length.
   2. Outer phyllaries 1–3 cm long, acute or attenuate, longer than the inner series, some or all of them usually spreading or reflexed.
      3. Linear tips of the pales 0.3–0.5 mm wide, hispid; lobes of the disk-corollas evidently puberulent; rays 8–13; long outer phyllaries usually narrowly acute or attenuate; leaves often hastately or pinnately lobed, seldom conspicuously serrate. *V. pantoptera* Blake.
      3. Linear tips of the pales 0.8–1.4 mm wide, glabrous; lobes of the disk-corollas glabrous; rays 15–22; long outer phyllaries usually short-acute; leaves not lobed, coarsely and doubly serrate. *V. hispida* McVaugh.
   2. Outer phyllaries 1 cm long or less, obtuse, evidently shorter than the inner series, appressed or loosely spreading.
      4. Leaves elliptic or oblanceolate, gradually narrowed to a sessile base; ray-flowers 11–13; lower valley of the Río Grande de Santiago. *V. tequilana* Coleman.
      4. Leaves with ovate or deltoid blade abruptly narrowed to a wing-margined petiolar base; ray-flowers 15–22; eastern Jalisco to eastern Mexico. *V. tetraptera* (Ort.) A. Gray.

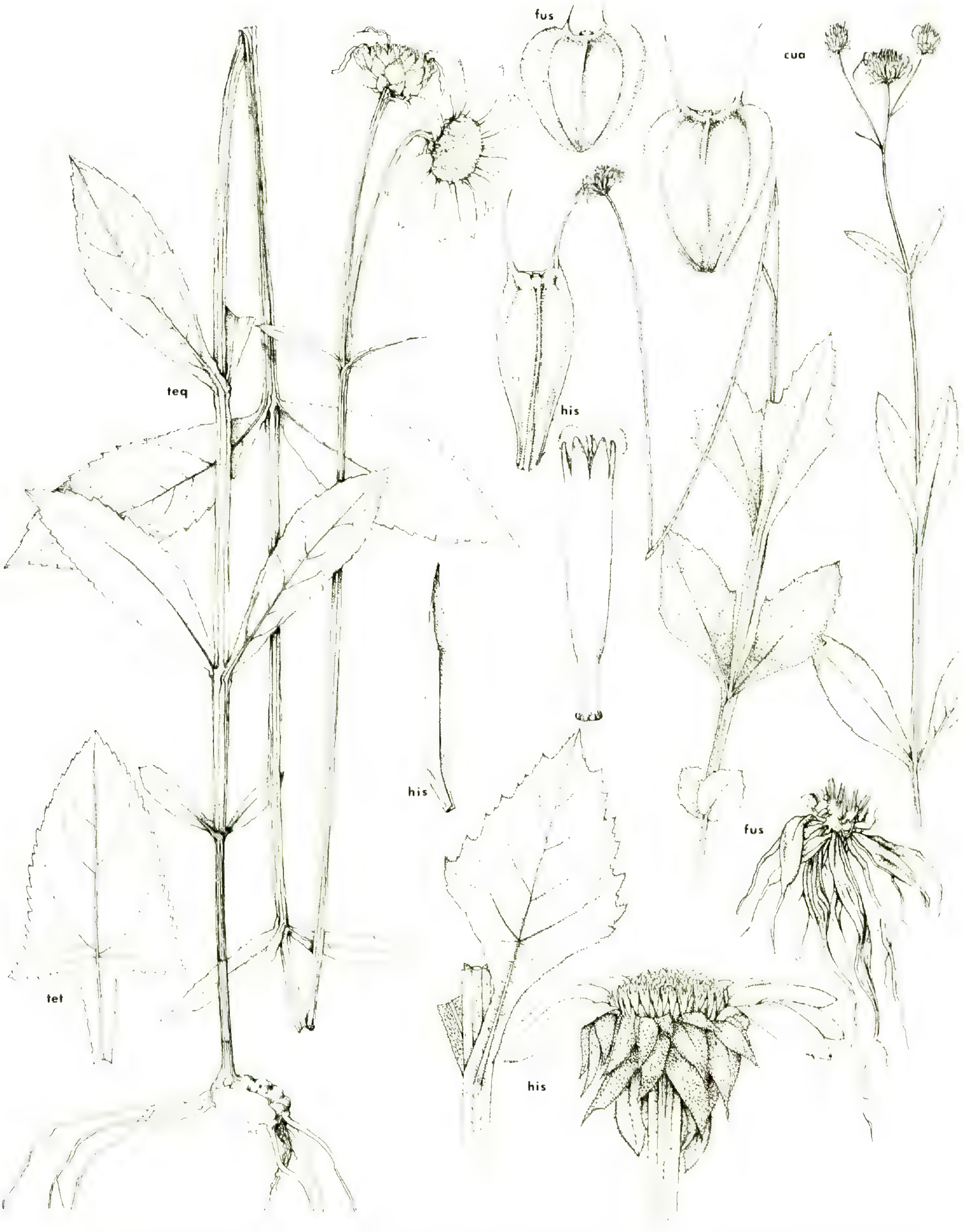

FIG. 42. Herbaceous species of *Verbesina*. **teq,** *V. tequilana* (*McVaugh 19074,* flowering plant, X ½). **tet,** *V. tetraptera* (*McVaugh 21932,* cauline leaf, X ½). **his,** *V. hispida* (*McVaugh 16582,* type; cauline leaf, X ½; flowering head with some ray-flowers removed, X 3/4; pale, X 2.5; disk-corolla, X 3.5; disk-achene, X 4). **cua,** *V. cuautlensis* (*McVaugh 19990;* flowering branch, X ½; disk-achene, X 4). **fus,** *V. fusiformis* (*McVaugh 16428,* type; flowering branch and cluster of fusiform roots, X ½; disk-achene, X 4).

1. Heads small, 1–1.5 cm across the disk; disk-flowers (30–) 40–60 (–75?); disk-corollas 5–6.5 mm long; rays neutral, or in some species pistillate and fertile; peduncles wingless at least above the upper cauline bracts.
   5. Lower leaf-surface essentially glabrous, bearing a few coarse hairs on the larger veins; pappus-awns 2.5–3.5 mm long; stems commonly branched above, with small bracts scattered along the peduncle-like branches. *V. cuautlensis* McVaugh.
   5. Lower leaf-surface evidently pubescent, usually coarsely and copiously so; pappus-awns less than 2 mm long; stems branched or with long naked solitary peduncles.
      6. Leaves sparsely short-strigose beneath, the hairs appressed, 0.2–0.3 mm long; leaves lance-ovate, sessile, denticulate; pappus awns about 1 mm long; foothills of northern Nayarit. *V. rosei* Rob. & Greenm.
      6. Leaves with numerous, coarse, rigid, more or less erect hairs beneath; leaf-shape and margins various.
         7. Herbage scabrous, the hairs on the leaves and the cauline wings seldom more than 0.5 mm long; awns of the disk-achenes 0.2–0.3 mm long, often appearing as minute projections on the mature achene-wing; roots never tuberous-thickened as far as known.
            8. Rays pistillate and fertile; heads solitary and terminal on naked peduncles 15–35 cm long; outer phyllaries green and leafy, 4–7 mm long, evidently different from the inner series, these 8–12 mm long; Durango to México. *V. pedunculosa* (DC.) Rob.
            8. Rays neutral; heads solitary or few, long-peduncled; phyllaries subequal, green, linear-lanceolate, 6.5–8.5 mm long; northern Nayarit. *V. madrensis* Greenm.
         7. Herbage hispid, many of the longer hairs on leaves and wings 1–1.5 mm long; awns of the disk-achenes 1–1.8 mm long; rays neutral; roots fusiform, 4–6 mm thick; southern Nayarit. *V. fusiformis* McVaugh.

Verbesina culminicola McVaugh, sp. nov.

Frutex procerus arboriformis 3-metralis, trunco basi 5 cm diametro, ramis erectis plerumque alternis, infra foliorum bases alatis, alis 1–2.5 mm latis, valde corrugatis, mox siccatis fragilibusque; partes vegetativae pilis gracilibus appressis 0.2–0.5 mm longis rare strigosae; rami hornotini, involucri basis pedunculique pilis similibus paullo dealbati; folia rigidiuscula, laevia, alterna vel ramorum brevium sterilium opposita, elliptici-lanceolata, ad basin apicemque subaequaliter attenuata vel apice acuta tantum sed basi attenuata, 8–20 cm longa, 1.5–3 cm lata, 4–7-plo longiora quam latiora, dentibus remotiusculis utroque latere 8–12 non profunde serrulata; petioli 0.5–1 cm longi, vel foliorum superiorum breviores; corymbus compositus polycephalus, densiusculus, 5–15 cm altus latusque ramis a bracteis anguste ellipticis vel oblanceolatis 0.5–4 cm longis subtentis; capitula hemisphaerica vel subglobosa, 6–8 mm alta, 8–10 mm lata, terminalia et axillaria, pedunculis 0.5–2 cm longis; involucrum 2-seriatum, phyllariis 10–11 sed ut videtur 5 solum, exterioribus herbaceis, interioribus carnosulis, ad paleas transientibus; phyllaria exteriora 5, 3–6 mm longa, 1–2.5 mm lata, basi angusta pallida rigida, apicibus crasse herbaceis, venosis, ampliatis, ellipticis vel spathulatis, obtusis vel subacutis; phyllaria interiora (radios subtendentia) plerumque carnosula, apiculata vel acuminata, ovata, 1–1.5 mm longa, vel unum ad 3 mm longum, apice viridi; flores radii 5–6, feminei, fertiles, ligulis flavis ca 5 mm longis, 2.5 mm latis, tubo piloso minus quam 1 mm longo; styli ramuli ca 1 mm longi, apicibus planis attenuatis; flores disci 40–50, corollis flavis 3.5 mm longis, tubo crasso piloso 0.5–0.8 mm longo, fauce subcylindrica, lobis subacutis 0.6 mm longis, glabris vel rare hispidulis; antherae pallide brunneae. 1.3–1.5 mm longae, appendicibus acutis 0.3–0.4 mm longis; styli ramuli ca 1 mm longi, apicibus deltoideo-acuminatis dilatatis; achaenia disci obovata alis inclusis 2–2.3 mm longa lataque, corpore nigrescenti, supra strigoso, alis albidis, dense ciliatis, 0.2–0.5 mm latis, supra achaenium productis et ad bases aristarum 2 subaequalium 1.3–1.5 mm longarum paullo adnatis; achaenia radii similia sed plerumque minora, saepe sub-3-angulata, vel ala aristaque interiore solum evoluta; paleae rigidae 2.5–3 mm longae, plicatae 1 mm latae, anguste carinatae, basi pallidae angustae, apicibus carnosulis, flavidis, apiculatis, cucullatis, apiculis erectis; receptaculum conicum, 1.5–2 mm altum latumque.

JALISCO: 25–30 km SE of Talpa de Allende, ca 20 km S of El Rincón, steep mountainsides above Aserradero La Cumbre, in fir forest with *Podocarpus* and deciduous trees, elev. 2000–2250 m, 29 Nov 1960, *McVaugh 21536* (MICH, type). Otherwise unknown.

This species is evidently related to the group that includes *Verbesina oncophora* Rob. & Seat., and *V. angustifolia* (Benth.) Blake. In all these the leaves are chiefly alternate, the stems tend to be winged, the ray-flowers are relatively small, and the pales a little fleshy, apiculate, truncate or hooded, often recurved at maturity. In *V. oncophora* the leaves are wider, 2.5–7 (–12) cm wide, 2.5–4 times as long as wide, with (15–) 25–50 teeth on each side. In *V. angustifolia* and *V. culminicola* the leaves

FIG. 43. *Verbesina culminicola* (*McVaugh 21536*, type). Flowering branch, X ½; flowering head, X 3.5; corollas, and pale, X 7.5; disk-achene, anthers, style-tips, X 10.

are seldom more than 3 cm wide, (4–) 5–8 (–12) times as long as wide, with (0–) 6–12 (–25) teeth on each side. In *V. angustifolia* the rays are mostly 8–13, the phyllaries 13–23, without marked contrast between inner and outer series, the tips of the pales recurved, and the leaves usually rough above.

Verbesina furfuracea McVaugh, sp. nov.

Arbor 5–7-metralis, trunco basi 20–30 cm diametro, ramulis vetustis dense basibus pilorum confertorum crassorum flavido-alborum obsitis; rami oppositi, alis

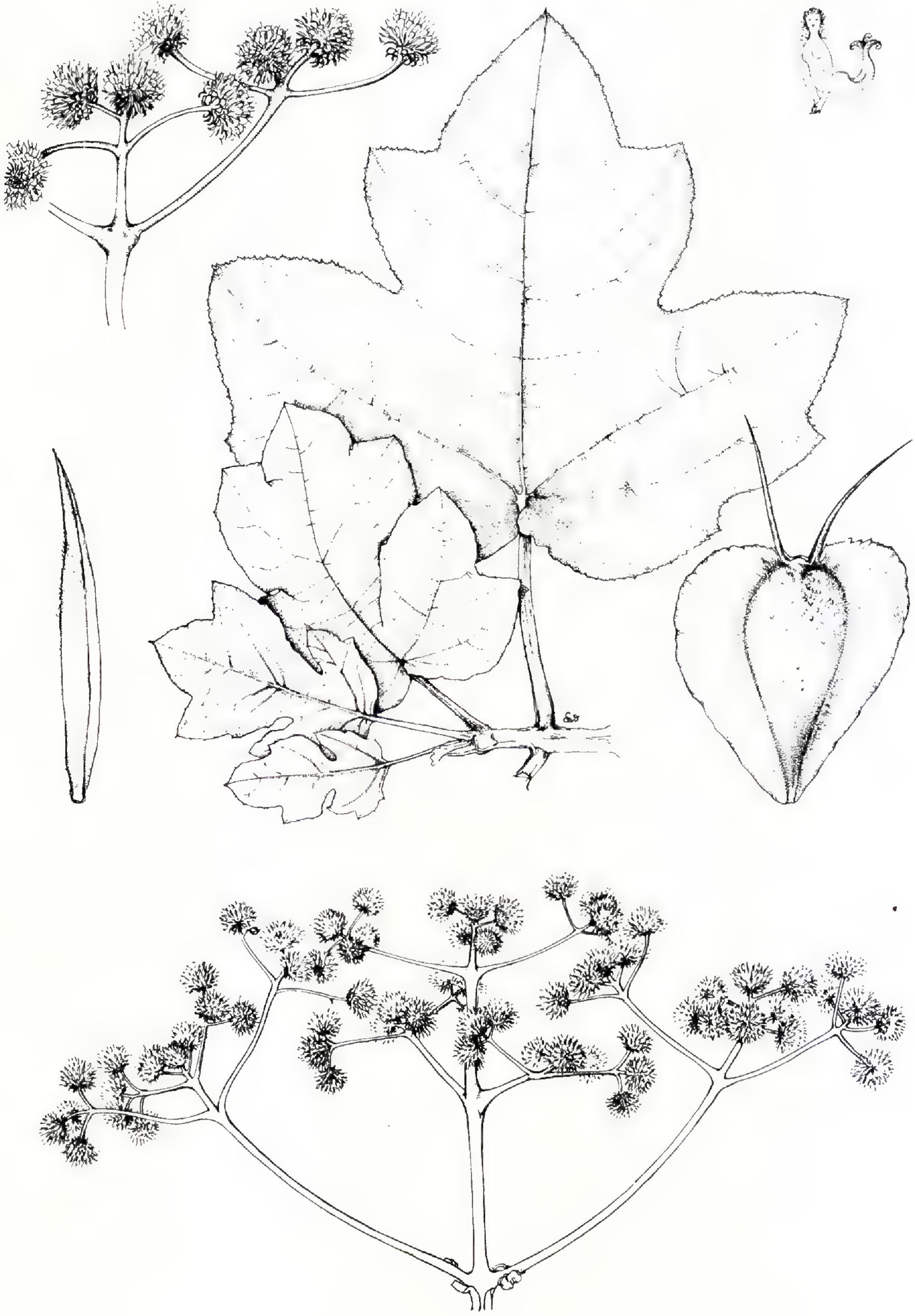

FIG. 44. *Verbesina furfuracea* (*McVaugh 24695*, paratype). Leafy branch and diagram of terminal part of fruiting inflorescence, X ¼; detail of inflorescence, X ½; disk-achene and pale, X 5.

nullis; folia supra pilis plurimis brevibus erectis rigidis subasperata, subtus pallida, valde reticulato-venosa, juvenilia velutino-canescentia, in venis praecipue pilis plurimis gracilibus molliusculis ascendentibus 0.3–0.5 mm longis obsita; folia magna, grossa, ovata, 15–30 cm longa, 10–16 (–30) cm lata, apice late acuta vel obtusa, basi late rotunda subcordata, denticulata, pinnatilobata, lobis utroque latere 1–2, deltoideo-ovatis acutis, 3–6 (–12) cm longis; petioli subteretes 3–10 cm longi, 2–5.5 mm crassi; inflorescentia verisimiliter dense pilosa vel hirsuta (emerita tantum visa), corymbosa, ad 30 cm alta lataque; capitula 10–15, vel usque ad 100, pedunculis terminalibus crassis (0.3–) 1–2.5 cm longis, lateralibusque gracilioribus et ut videtur ebracteatis 2–5 cm longis suffulta; capitula statu fructifero subglobosa, 1.5–2.5 cm diametro; phyllaria ca 15 crassa, ut videtur viridia, ovato-triangularia, subacuta 1.5–4 mm longa, exteriora ut videtur breviora; flores non visi; flores disci ca 75–100; achaenia late obovata, alis inclusis 5–7.5 mm longa et 4–5.5 mm lata, corpore griseo glabro 1.7–2 mm lato, alis 1.5–2 mm latis, albidis, ciliatis, supra achaenium productis et ad bases aristarum 2 inaequalium vel subaequalium 3–5 mm longarum adnatis; paleae lineares, statu fructifero coriaceae 7–9 mm longae plicatae 0.8 mm latae, apicibus acutis, saepe paullo recurvatis; receptaculum 5–6 mm latum.

JALISCO: Steep rocky mountainsides, on limestone, 12–13 km SW of Pihuamo, in dense deciduous forest with *Plumeria, Ficus, Bursera, Louteridium, Tithonia koelzii,* elev. 500–600 m, 6 Dec 1959, *McVaugh & Koelz 1524;* 19 Nov 1970, *McVaugh 24448* (MICH, type).

MICHOACAN: 15–16 km SE of Aserradero Dos Aguas and nearly west of Aguililla, on tumbled and eroded limestones, with *Plumeria, Bursera, Louteridium,* elev. 1400–1450 m, 25–26 Nov 1970, *McVaugh 24695.*

This is a distinctive plant of the limestone areas in Jalisco and western Michoacán that support a number of other narrow endemics. It seems clear even in the absence of flowering material that it is markedly different from any known species of *Verbesina.*

Verbesina fusiformis McVaugh, sp. nov.

Herba perennis erecta tenuis, caulibus florentibus paucis ad 50 cm altis, simplicibus, capitulum solitarium terminale longipedunculatum erectum ferentibus, e caudice brevi lignoso interdum ramoso, radicum tuberosarum fusiformium 4–6 mm crassorum fasciculum efferenti, oriundis; caules foliosi alati, alis 4, 0.5–3 mm latis, pedunculis nudis exalatis 15–35 cm longis, 1–1.7 mm crassis, characteribus omnis ut in *Verbesina pedunculosa* sed partibus vegetativis grosse hispidis non rare hispidulis; caules inferne hirsuti, pedunculis involucrisque pilis rigidis appressis 0.4–0.8 mm longis obsitis; folia pilis conicis erectis 0.5–1 mm longis scabra, pilis supra e discis cellularum vitrearum erumpentibus, subtus in venis numerosioribus, discis cellularum vix prominentibus; folia sessilia, (1.5–) 3–6 cm longa, (1–) 1.5–3 cm lata, obovata vel superiora oblanceolata vel elliptica, apice obtusa vel subacuta, basi cuneata vel sensim angustata, interdum prope medium oblique bilobata (lobis deltoideis ad 5–8 mm altis), marginibus irregulariter acuteque dentatis vel denticulatis; capitula florentia non visa, statu fructifero hemisphaerica vel subglobosa 1–1.7 cm lata, involucro subrotato; phyllariis biseriatis ca 17–20; phyllaria exteriora viridia 6–8, crassa, foliacea, laxiuscule patentia, oblonga, obtusa, 4–6 mm longa, 1–1.5 mm lata; phyllaria interiora (radios subtendentia) 6–8 mm longa, lanceolata vel elliptico-lanceolata, acuta vel subacuta, apicibus viridibus, vel tenuioribus et phyllariis ad paleas plusminusve transientibus; flores radii ca 11–13, steriles, ut videtur neutri; flores disci ca 50, corollis ca 5 mm longis, basi dilatatis induratisque; antherae ca 3 mm longae, appendicibus ovatis acutis 0.6 mm longis; achaenia disci late obovata, alis inclusis 4.5–5.5 mm longis, 4–5 mm latis, corpore glabro pallide brunneo 2.5–2.9 mm lato, alis cartilagineis ciliatis 0.5–1.3 mm latis, supra achaenium productis et ad aristas 2 aequales vel subaequales 1–1.8 mm longas adnatis; paleae papyraceae 7–8 mm longae, plicatae 1–1.5 mm latae, apicibus longiciliatis acutis attenuatis.

NAYARIT: In oak forests with scattered pines, km 870, ca 35 km SE of Tepic, elev. 1150 m, 26 Aug 1957, *McVaugh 16428* (MICH, type). Known only from the type-collection.

This species is superficially very similar to *V. pedunculosa* (DC.) Rob.; see the key above, under *V. cuautlensis*. *V. pedunculosa* is a species known chiefly from the Central Plateau of Mexico, at elevations of 1900 to 2300 m. It differs from *V. fusiformis* in a number of individually trivial characters (e.g. pubescence, achene-shape, and size of pappus awns), and also in some ways not yet fully understood. Fusiform roots like those of *V. fusiformis* have not been observed in *V. pedunculosa*, and in the latter species the rays are consistently fertile as far as known, whereas in all the plants of the type-collection of *V. fusiformis* they appear to be sterile.

Verbesina hispida McVaugh, sp. nov.

Herba perennis erecta, caulibus florentibus solitariis vel paucis, exemplis visis 30–60 cm altis, 2–5 mm crassis, simplicibus, quadrialatis (alis 1–3.5 mm latis), capitulo solitario pedunculum alatum 6–20 cm longum terminanti; planta omnino hispida, caulibus inter alas pilis paucis instructis; folia supra scabra, pilis erectis rigidis conicis curvatis 0.5–1 mm longis e discis pallidis cellularum vitrearum erumpentibus crebre obsita; folia subtus pilis grossis 1–2.5 mm longis e cellulis 4–7 compositis in venis instructa, inter venas plerumque glabra; folia (pedunculi bracteis exceptis) opposita, 10–12, subtriplinervia, laminis ovatis 5–9 cm longis, 3–7.5 cm latis, rhomboideis vel deltoideis, apice acutis vel breviacuminatis, basi abrupte contractis (marginibus basalibus fere rectis), petiolis marginatis oblongis vel cuneatis 2.5–5 cm longis, prope laminam 0.8–2 cm latis, prope basin 0.5–1 cm latis et in alas caulinas decurrentibus; margines laminarum utroque latere dentibus 5–10, 1–7 mm altis grosse duplicato-serratae, dentibus primariis plerumque dentatis vel denticulatis; folia superiora inferioraque minora; internodia superiora 8–16 cm longa; capitula magna, sub anthesi nutantia, fructu erecta, 4–6 cm lata (radiis extensis mensa), disco 1.5–2 cm lato; involucrum 2–3-seriatum, verisimiliter initio hemisphaericum, phyllariis exterioribus mox laxe patentibus vel reflexis; phyllaria ca 40–50, lanceolata vel elliptica vel oblanceolata, exteriora longiora, subaequalia, crassa, herbacea, rigide hispida, 1.2–2 cm longa, 4–6 mm lata, apicibus acutis callosis; phyllaria (radios subtendentia) breviora angustioraque, 1–1.5 cm longa, 2–4 mm lata, basi pallida rigida, apicibus acutis viridibus vel scariosis, intima ad paleas sensim transientia, ciliata, cetera glabra vel subglabra; flores radii 15–22, neutri, ligulis flavis 1.5–2.5 cm longis, 4–6 mm latis, tubo glabro 2.5–4 mm longo, basi dilatato induratoque; flores disci numerosi (150–200 vel ultra), corollis flavis 10–11.5 mm longis, extus glabris, tubo 2–2.5 mm longo, 1–1.3 mm crasso, basi dilatato induratoque, fauce subcylindrica, lobis subacutis angustis incurvatis 2–2.3 mm longis, marginibus intus minute ciliatis; antherae nigrescentes 3.3–4 mm longae, appendicibus acutis breviovatis 0.4 mm longis; styli ramuli 3.5–4.5 mm longi, apicibus angustis attenuatis; achaenia disci (paullo immatura) obovata, alis inclusis 5.5–7 mm longa, corpore glabro 2–2.5 mm lato, alis ciliatis distaliter 0.3–0.7 mm latis, supra achaenium productis, ad bases aristarum subulatarum 2 subaequalium, 1.5–4 mm longarum adnatis, et inter aristas margine angustissima connexis; achaenia radii trigona, abortiva; paleae rigidae 11–13.5 mm longae, plicatae 1.3 mm latae, lateribus plerumque brevidentatis, apicibus linearibus glabris, acutis vel acuminatis 4–5 mm longis, 0.8–1.4 mm latis, subrecurvatis; receptaculum convexum.

NAYARIT: Steep treeless grassland hills ca 16 km SE of Tepic (3 km SE of El Refugio), elev. 1000–1100 m, 30 Aug 1957, *McVaugh 16582* (MICH, type); grassy openings above the lake, NE of Santa Maria del Oro, elev. 1000 m, 18–20 Aug 1959, *Feddema 655, 690.* Otherwise unknown.

This species superficially resembles *Verbesina pantoptera* Blake, from which it can readily be distinguished by the characters used in the key above (under *Verbesina cuautlensis*).

Verbesina mickelii McVaugh, sp. nov.

Frutex erectus copiose ramosus 2–3-metralis, ramis foliisque plerumque oppositis, ramulis teretibus vel angulatis, vix alatis; partes vegetativae sublaeves, pilis rigidis

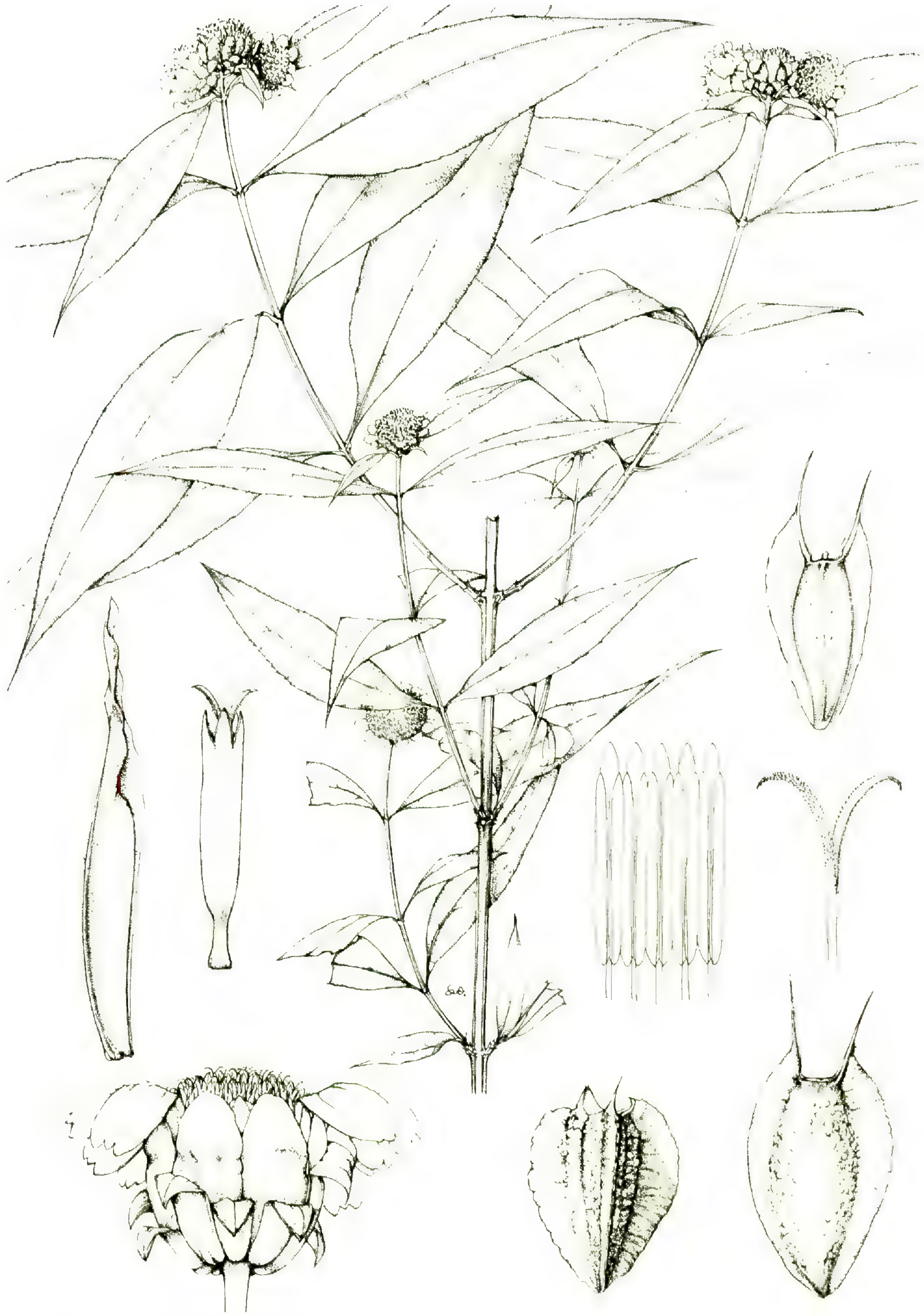

FIG. 45. *Verbesina mickelii.* Flowering branch, X ½; flowering head, X 1.5; disk-corolla, pale, immature achene (right center), X 5; style-tips, X 7.5; anthers, X 10 (all from the type, *McVaugh 16054*). Disk-achene (lower right) and ray-achene, X 5 (*McVaugh 24962*).

pallidis appressis ca 0.1–0.3 mm longis aequaliter sed sparsiuscule obsitae; folia membranacea, lanceolata, penninervia, 8–13 cm longa, 2–3.5 cm lata, 3.7–5-plo longiora quam latiora, apice attenuata vel anguste acuminata, basi paullo rotundata, cuneata, sessilia vel petioli parte nuda 1–2 mm longa, marginibus supra basin utroque latere dentibus 12–20 serrulato-denticulatis; capitula terminalia solitariaque, pedunculis incrassatis ad 1 cm longis et 1–2 mm crassis suffulta, vel 2–3 in fasciculis terminalibus conferta, hemisphaerica vel demum subglobosa, 3 cm lata (radiis extensis mensa), disco sub anthesi 1.5 cm lato, fructu 2–2.5 cm lato; involucrum hemisphaericum, ca 3-seriatum, 12–15 mm altum, prope basin late rotundatum vel subtruncatum ca 1 cm latum; phyllaria ca 21–24, foliacea vel membranacea, basi rigida, apicibus tenuibus, obtusis vel rotundatis; phyllaria exteriora 8–10 foliacea, 5–10 mm longa, 2–5 mm lata, apicibus laxe patentibus vel reflexis, angustis vel saepe dilatatis, ellipticis vel spathulatis; phyllaria interiora (radios subtendentia) longiora latioraque vel intima angustiora subacuta 2–3 mm lata et ad paleas transientia, omnia membranacea vel majora subfoliacea ad 12–15 mm longa, 5–8 mm lata; flores radii ca 11, ligulis flavis, oblongo-ovatis, apice dentatis, ca 1 cm longis et 5 mm latis, tubo 3 mm longo basi dilatato; styli ramuli longe exserti 2.5 mm longi; flores disci 80 vel ultra, corollis flavis 7.5–8 mm longis, tubo 1.3–2 mm longo, basi dilatato induratoque, fauce cylindro-campanulata, lobis acutis 1–1.5 mm longis; antherae nigrescentes 3 mm longae, appendicibus acutis 0.5 mm longis; styli ramuli breviacuti 2.5 mm longi; achaenia disci obovata, alis inclusis 5–7 mm longa et 3–5 mm lata, corpore nigrescenti brevistrigoso, 1.8–2.2 mm lato, alis albidis 0.3–0.8 (–1.5) mm latis (interiore saepe latiore), supra achaenium productis et ad bases artistarum 2 subaequalium hispidularum canaliculatarum 2–3.5 mm longarum adnatis; achaenia radii trigona, 3-alata, aristis 3 brevibus munita; paleae papyraceae (10–) 12–14 mm longae, plicatae 1.5 mm latae, apicibus mollibus linearibus attenuatis vel acutis.

Species in honorem dixi John Thomas Mickel (1934–) nunc noveboracensis, qui mecum plantas praecipue colimenses anno 1957 collectavit.

COLIMA: Mountain summits near the pass 17–18 km SSW of Colima on the Manzanillo road, in deciduous forest over slate and gypsum, elev. 500 m, 10 Aug 1957, *McVaugh 16054* (MICH, type); 21 Sep 1958, *McVaugh 18050;* 3 Dec 1970, *McVaugh 24962.* Abundant at the type locality; otherwise unknown.

Apparently not closely related to any other species in western Mexico, *Verbesina mickelii* differs technically from *V. langlassei* Rob. and *V. sphaerocephala* A. Gray (the other species with opposite leaves and few small or medium-sized short-peduncled and leafy-bracted heads), in having the branchlets not at all or at most obscurely winged, the leafy tips of the outer phyllaries 5–10 mm long and much longer than wide, the fruiting heads 2 cm wide or more, the pales mostly 12–14 mm long and the disk flowers 80 or more.

Verbesina oncophora Rob. & Seat., var. **subhamata** McVaugh, var. nov.

Frutex procerus vel arborescens 2–5-metralis, ramis alternis plerumque alatis; a var. *oncophora* pubescentia sparsiuscula, foliis angustioribus ellipticis (raro ovatis), plerumque 2.5–6.5 cm latis, achaeniis minoribus 2.5–3.4 mm longis, glabris vel distaliter strigosis, paleis rectis vel recurvatis, differt.

TYPE: JALISCO: Sierra de Manantlán, 25–30 km SE of Autlán, in pine and fir forests near the summits between El Chante and Cuzalapa, elev. 2500–2750 m, 20–21 Mar 1965, *McVaugh 23112* (MICH).

A characteristic shrub in the mountains from southern Durango through Jalisco to western Michoacán, in pine or pine-fir forest at elevations from 2000 to 3000 m. The var. *oncophora* is unknown from Nueva Galicia but occurs in Morelos, in the State of Mexico, and the Distrito Federal. The original specimens came from near Mexico City (*Pringle 4310!, Bourgeau 967!,* syntypes, both at GH). The cauline leaves tend to be ovate rather than elliptic, and 5–8 cm wide; the inflorescence is densely short-

pubescent and subcanescent, the achenes are larger and more generally pubescent than those of var. *subhamata,* and the points of the pales may be noticeably recurved, whereas in most specimens from Nueva Galicia the tips are erect or nearly so.

Verbesina sphaerocephala A. Gray, var. **dubia** McVaugh, var. nov.

Frutex var. *sphaerocephalae* habitu characteribusque foliorum et inflorescentiae simillimus, sed foliis anguste ovatis (2–) 2.5–3.5-plo longioribus quam latioribus, subtus pilis arcte appressis 0.3–0.5 mm longis vel brevioribus obsitis.

NAYARIT: SE of Ahuacatlán, 1100–1300 m, 17–18 Nov 1959, *McVaugh & Koelz 734;* between Mazatán and Las Varas, 600–900 m, Aug 1959, *Feddema 1109;* Nov 1963, *Feddema 2658.*

JALISCO: Mountains 8 km NNE of Talpa de Allende, in oak forest, elev. 1500 m, 14 Oct 1960, *McVaugh 20180* (MICH, type); Mpio. de Cabo Corrientes, S of El Tuito, elev. 250–300 m, 15 Dec 1970, *McVaugh 25433;* Mpio. de Tomatlán, Llano Grande, elev. 350 m, 21 Nov 1960, *Feddema [McVaugh 21263],* 23 Nov 1960, *Rzedowski 15189.*

Rzedowski's plant from Llano Grande is typical of this variety, but Feddema's collection from the same locality is indistinguishable from *V. mickelii* in aspect and in foliage-characters, although the heads are those of *V. sphaerocephala.*

The var. *sphaerocephala* occurs widely from Nayarit to the State of Mexico and Guerrero, apparently ranging inland farther than the var. *dubia.* The leaves tend to be ovate, 1.75–2.5 (–3) times as long as wide, the lower surface bearing many stiff and mostly erect hairs 0.5–0.8 mm long.

Viguiera blakei McVaugh, sp. nov.

Arbor 5–10-metralis, trunco ad 15 cm diametro, ramis foliisque oppositis vel inflorescentiae ramulis ultimis alternis; rami pedunculique crispato-puberulentes, pilis rectis longioribus 0.5–0.8 mm longis etiam instructi; folia supra pilis brevibus conicis attenuatis asperata, subtus in venis pilosa et glanduloso-puberulentia, inter venas subglabra resinoso-globulifera, in venarum axillis barbata, venulis minoribus impressis, pagina inferiore bullata; phyllaria versus apices rare pubescentia, versus basin densiore; folia triplinervia ovata, petiolis marginibus valde corrugatis alatis; folia principalia 25–30 cm longa, 20–25 cm lata, petiolis (e basi ad venarum 3 majorum juncturam mensis) 10–13 cm longis, alis 1–2 cm latis basi subamplexicaulibus; folia superiora (basi inflorescentiae posita) 15–20 cm longa, petiolis 2–4 cm longis; laminae apice acuminatae, basi in petiolum alatum abrupte rotundatae, marginibus utroque latere dentibus ad 50 non profunde crenato-serratis, vel bractearum foliacearum integris; capitula pauca, magna, quoque ramo florenti 10–20; inflorescentia pauciramosa, ramis divaricatis capitulis plerumque binis vel ternis, terminalibus axillaribusque, pedunculis bracteatis 3–10 cm longis, 2 mm crassis; capitula florentia 9–12 cm lata (radiis extensis mensa), disco 3–3.5 cm lato; involucrum late cyathiforme, ad apice pedunculi impressum, ca 3-seriatum; phyllaria 39–45, rigidiuscula, lanceolata, 1.5–2.5 mm lata, ad apices acutos, angustos vel subcapilliformes attenuata, exteriora gradatim breviora, extima 7–11 mm longa, intima (radios subtendentia) 11–14 mm longa; flores radii 19–24, ligulis aureis oblanceolatis 3–4 cm longis, 1–1.5 cm latis, apice obtusis, prope basin abaxiale pubescentibus, tubo pubescenti 3 mm longo; flores disci ca 150, corollis rubro-aurantiacis 8–9.5 mm longis, anguste tubuloso-infundibuliformibus, tubo puberulenti ca 2 mm longo, lobis triangulari-ovatis 1.5–2 mm longis; antherae flavo-brunneae, basi auriculatae, 4 mm longae, appendicibus anguste ovatis 1 mm longis; styli ramuli lineares 3.5 mm longi; achaenia lucida subnigrescentia 6.5 mm longa, compressa, ambitu obovata, 2.5–2.7 mm lata, apice appresse pubescentia; aristae 2 erectae, 7–8.5 mm longae, planae, rigide coriaceae, lineari-ellipticae, 1.5–2 mm latae, marginibus supra medium erosis, apicibus truncatis brevicuspidatisque, basibus per discum planum cartilagineum connexis, disco utroque latere squamellis 1–3 erosis plusminusve unitis 0.1–0.7 mm altis instructo; paleae rigide coriaceae, acuminatae, fructu ca 1 cm longae, in tubum achaenia involventem involutae, apicibus puberulenti-

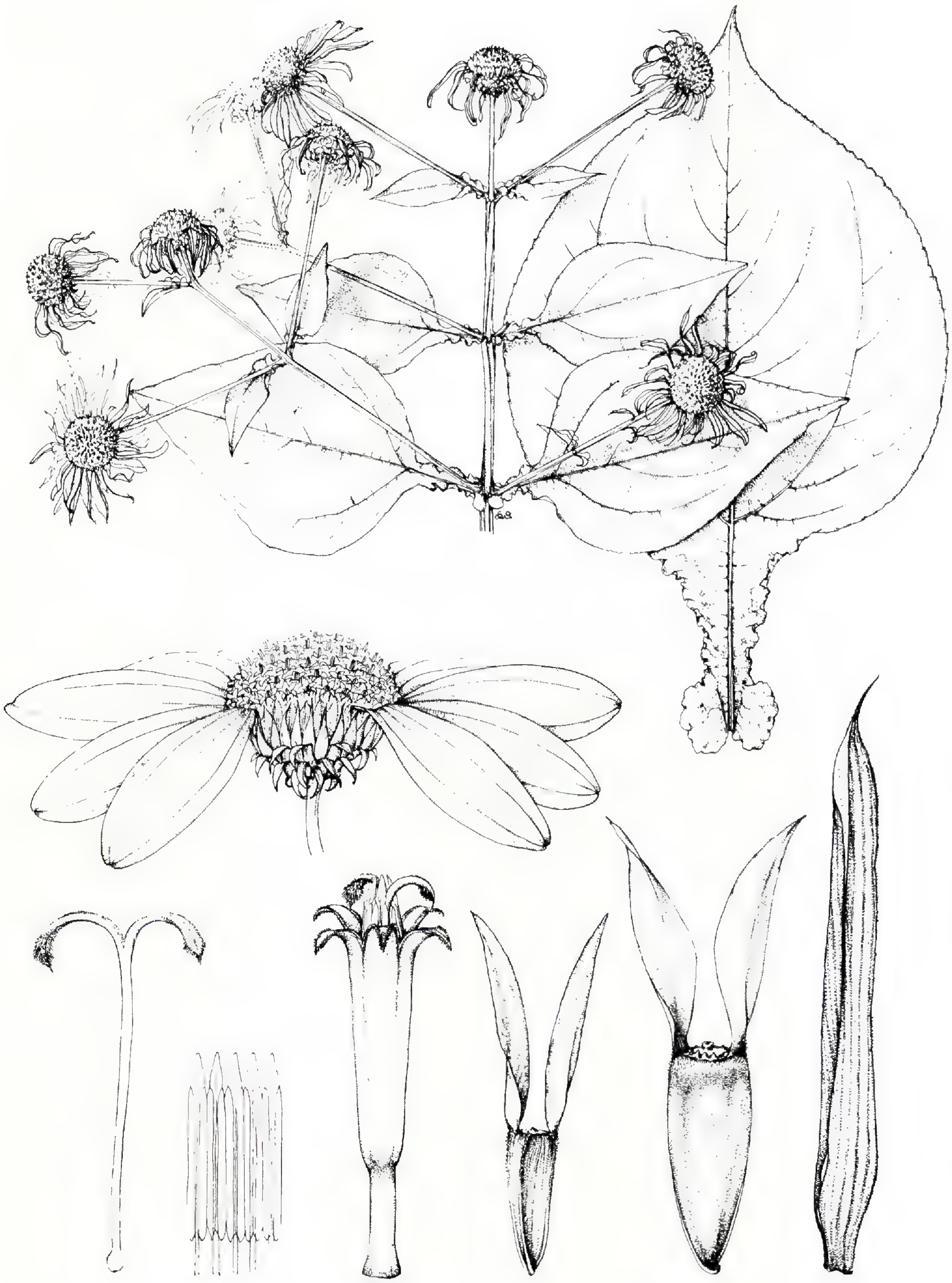

FIG. 46. *Viguiera blakei* (*McVaugh 24722,* type). Cauline leaf, and diagram of inflorescence, X ¼; flowering head with some rays removed, X 3/4; disk-corolla, achenes, pale, anthers, and style-branches, X 5.

bus subaristatis, aristis planis erectis 1 mm longis; receptaculum statu fructifero minus quam 1 cm latum.

Species in memoriam cl. Sidney Fay Blake (1892–1959), Compositarum expositoris singularis, cui inter alia debetur "A revision of the genus *Viguiera,*" dicavi.

MICHOACAN: Coalcomán, on tumbled and eroded limestone rocks, in mixed deciduous forest of *Cordia, Quercus, Bursera, Ficus, Eupatorium,* nearly W of Aguililla and 16–18 km SE of Aserradero Dos Aguas, elev. 1400–1500 m, 26 Nov 1970, *McVaugh 24722* (MICH, type).

MEXICO: Dist. Temascaltepec, Salitre, 7 Nov 1935, *Hinton 8725* (GH).

GUERRERO: Dist. Montes de Oca, Vallecitos, 10 Dec 1937, *Hinton 11653* (GH, MICH); Dist. Mina, Campo Morado to Otatlán, elev. 1200 m, 13 Nov 1939, *Hinton 14833* (GH, MICH).

At the type locality, these trees make an extraordinary show as they come into flower in a thin forest from which many of the leaves have already fallen. From *Viguiera sphaerocephala* (DC.) Hemsl., another arborescent species with large heads and long-petioled leaves, *V. blakei* differs in having petioles with broad ruffled wings extending nearly to the base (petioles wingless in *V. sphaerocephala*), the achenes glabrous except near the apex (not densely appressed-pubescent), the pappus-awns 7–8.5 mm long with squamellae less than 1 mm long (not 3–5 mm long with squamellae 1.5–2.5 mm long).

Viguiera grahamii McVaugh, sp. nov.

Herba perennis basi lignosa 1.5–2-metralis, superne ramosa, diffusa, caulibus teretibus basi 5 mm crassis vel crassioribus; partes vegetativae fere glabrae gummosaeque, pedunculis, phyllariorum apicibus marginibusque et foliis supra plerumque pilis paucis brevibus instructis; folia penninervia, supra plantae medium saltem alterna, utrinque subaequaliter viridia, lanceolata vel late lineari-elliptica, 7–18 cm longa, 0.8–3 cm lata, 6–10 (–13)-plo longiora quam latiora, ad apicem basinque attenuata (apice plerumque quam basi paullo productiore), marginibus remote obscureque denticulatis, petiolis 3–6 mm longis vel brevioribus; inflorescentia laxa polycephala foliosa rotundata paniculiformis 30–50 cm alta, ramis numerosis ascendentibus 10–30 cm longis, capitulis plerumque prope ramorum apices binis vel ternis, terminalibus axillaribusque, pedunculis 0.5–3 cm longis; capitula florentia 3–3.5 cm lata (radiis extensis mensa), disco subgloboso ca 1 cm lato; involucrum late cyathiforme, pedunculi apice profunde impressum, 7–8 mm altum, 8–9 mm latum, manifeste biseriatum; phyllaria 23–26, in siccitate viridia vel basi flavo-brunnea, exteriora subaequalia 11–13, lineari-lanceolata 6–7 mm longa, 0.8–1.6 mm lata, ad apicem induratum attenuata; phyllaria interiora (radios subtendentia) 12–13, 7–8 mm longa, basibus latis; rigidis incurvatis valde striatis, apicibus membranaceis obtusis 2–3 mm latis; flores radii neutri 12–15, ligulis aureis, elliptico-ovatis, obtusis, 10–12 mm longis, 3–4.5 mm latis, tubo puberulenti 1 mm longo; flores disci ca 150, corollis aureis 3.5–4 mm longis, tubo pubescenti 1 mm longo, fauce cylindrica basi ampliata indurataque, lobis ovato-triangularibus 0.7 mm longis; antherae nigrescentes 1.7 mm longae, basi auriculatae, appendicibus rigidis ovatis 0.6 mm longis; styli ramuli ca 1 mm longi, late lineares, apicibus subdilatatis acutis pilosis; achaenia nigrescentia, glabra, paullo compressa 4-angulataque, ambitu obovata 2 mm longa, 0.9 mm lata; pappus nullus; paleae papyraceae, conduplicatae, 4.5–5 mm longae, acuminatae, vetustiores purpureae; receptaculum conicum, statu fructifero 4 mm latum.

Species discipulo adjutorique William Lyle Graham (1946–), qui mecum plantas mexicanas praecipue jaliscenses anno 1970 collectavit, nominavi.

JALISCO: Grassy openings near the summit of the highway pass 14–15 km SW of Autlán, in oak-forest, elev. 1200–1300 m, 10 Dec 1970, *McVaugh 25240* (MICH, type); same locality, 28 Dec 1957, *R. Alava & S. A. Cook 1674.*

Known only from the one locality, where Mr. Graham collected the type-material. The following plants are very abundant and conspicuous at the type-locality, and it is surprising that such a showy species has not heretofore been noticed by botanists, many of whom have collected along the same highway in recent years.

In Blake's key to *Viguiera* this at once runs out to *V. latibracteata* (Hemsl.) Blake (subgenus *Amphilepis*), a plant of western Durango and adjacent Sinaloa. *V. grahamii,* however, is more nearly glabrous than *V. latibracteata,* with somewhat smaller heads. From *V. latibracteata* and related species of subg. *Amphilepis,* including *V. flava* (Hemsl.) Blake, and *V. hypochlora* (Blake) Blake, it differs in having pinnately nerved (not triplinerved) and essentially glabrous leaves 6–10 (–13) times as long as wide. In the other species the leaves are usually plainly triplinerved, pubescent or strigose, 2–4.5 (–6) times as long as wide. The characters separating all these and some other

FIG. 47. *Viguiera grahamii* (*McVaugh 25240,* type). Flowering branch, X ½; flowering head with some rays removed, X 2; disk-corolla and pale, X 7.5; anthers, style-tips and achene, X 10.

species are not very well understood, and the group as a whole should be revised when more material becomes available.

Viguiera kingii McVaugh, sp. nov.

Herba annua vel perennis (partibus hypogaeis ignotis) 50 cm alta; caulis solitarius basi 2 mm crassus, purpureus, inferne glaber, superne minute puberulus strigosusque, pedunculis densius strigosis; phyllaria pilis basi crassis quam rami grossius strigosa; folia supra pilis plurimis brevibus rigidis attenuatis asperata, subtus fere glabra, puberula sed non resinoso-globulifera, venis pilis paucis crassis instructis; folia (inferiora opposita, superiora in inflorescentia alterna, minora) triplinervia, ovata, principalia 5–7 cm longa, 3–3.5 cm lata, acuta vel apice obtuso apiculatoque, basi rotundata vel subcordata, marginibus utroque latere dentibus 8–10 remote serratis, petiolis 3–6 mm longis; capitula exemplo typico 9–10, ca 3 cm lata (radiis extensis mensa), in pedunculis axillaribus 6–10 cm longis, vel caulem ramosque pedunculis 2.5–3 cm longis terminantia; involucrum breve campanulatum 11–12 mm altum, 2-seriatum; phyllaria

FIG. 48. *Viguiera kingii* (*King 3675*, type). Flowering branch, X ½; flowering head with some rays removed, X 2.5; ray-corolla, X 3.5; disk-corolla, achene, pale, X 5; anthers and style-tips, X 10.

subaequalia ca 13–16, anguste lanceolata, 1.3–2.5 mm lata, ad apices acutos subulatos attenuata, omnino foliacea sed basi subrigida; phyllaria exteriora sterilia 5–6, plerumque quam interiora (radios subtendentia) laetius viridia; flores radii neutri ca 8, ligulis flavis 9–10 mm longis, 3 mm latis, tubo minute pubescenti 1 mm longo; flores disci ca 50, corollis flavis 5 mm longis, tubo 1 mm longo, fauce campanulata, lobis minute hispidulis 1–1.3 mm longis; antherae nigrescentes, 2.2–2.4 mm longae, appendicibus 0.7–0.8 mm longis; styli ramuli 1.5 mm longi, apicibus attenuatis hirsutis; achaenia nigrescentia, clavata, obtuse 4-angulata, apice truncata, 3.7–4 mm longa, 1–1.3 mm lata, arcte appresse pilosa; pappus nullus, vel ex arista solitaria 0.25 mm longa rudimentaria constans; paleae papyraceae 8–8.5 mm longae, valde nervatae, alveiformes, dorso et prope apices acutos, acuminatos, hispidulae.

Species collectori Robert Merrill King (1930–), qui mecum plantas mexicanas plurimas communicavit, nominavi.

NAYARIT: "Fields along route 15," ca 11 mi [17–18 km] SE of Tepic, elev. ca 1000 m, 10 Aug 1960, *King 3675* (MICH, type). Known only from the type-collection.

In *Viguiera* the achenes may be either glabrous or appressed-pilose. Sometimes both forms occur in the same species. Glabrous achenes are usually quite without pappus. Pubescent achenes usually bear awns and squamellae; in fact pubescent but epappose achenes are almost unknown in this genus. It may be that *V. kingii* represents an aberrant plant of a normally pappose species, but I cannot identify it with any known Mexican *Viguiera,* with or without pappus.

Viguiera palmeri A. Gray, var. **rzedowskii** McVaugh, var. nov.

Frutex debilis subscandens var. *palmeri* similis sed pilis foliorum gracilioribus, foliis subtus pilis crassis rigidis in venis munitis, venulisque pilis minoribus debilioribus obsitis, phyllariis exterioribus late lanceolatis 5–8 mm longis, 1.5–2.5 mm latis, apicibus viridibus reflexis 2–5 mm longis.

JALISCO: 3 km E of Mezquitic, hillsides in tropical deciduous forest over igneous rocks, elev. 1700 m, 4 Nov 1963, *Rzedowski 17652* (MICH, type).

In var. *palmeri* the outer phyllaries are 8–14 mm long, their green reflexed or recurved tips 5–12 mm long.

The outer pales in *Viguiera palmeri* in age become thickened and puckered, and because of this Blake transferred the species to a new genus, *Rhysolepis* (Contr. Gray Herb. II. 52: 37. 1917), remarking at the same time that "its general characters and its pappus . . . are essentially those of *Viguiera.*" The inner rows of pales in fact are progressively narrower and less puckered; the innermost are flat and conduplicate as in most other species of *Viguiera.* It does not seem to me that a generic separation can be justified in this case. Similar situations obtain in other well-marked genera of the Heliantheae, as in *Jaegeria,* where the pales may be all thin, or with the outer series thickened, or all indurated and thickened.

Wedelia acapulcensis H.B.K. Nov. Gen. & Sp. 4: 215. 1820. *Wedelia strigosa* Hook. & Arn. Bot. Beech. Voy. 435. 1841. *Aspilia strigosa* (Hook. & Arn.) Hemsl. Biol. Centr. Am. Bot. 2: 171. 1881.

The original specimens of *Wedelia acapulcensis* and *W. strigosa* were without mature achenes, but from their other similarities to mature modern specimens from the type-locality of both species (Acapulco, Guerrero) it is assumed that both represented a population in which the ray-flowers are consistently sterile.

Traditionally *Wedelia* has been circumscribed so as to include species with fertile rays, obtusely angled achenes, and cup-shaped awnless or short-awned pappus. The distinction between *Wedelia* and *Aspilia* (in which the rays are neuter or pistillate but sterile) is not always clear, as even in species with normally fertile rays one may find some or many ray-flowers with undeveloped achenes. The distinction between *Wedelia* and the Sect. *Auchenocarpa* of *Zexmenia* is similarly difficult; normally the ray-

achenes are fertile and rather noticeably winged in Sect. *Auchenocarpa,* but in individuals of many species the wings may be greatly reduced, and some or all achenes may be sterile. It seems that one can demonstrate a series leading to partial or total sterility of the ray-flowers, and it appears that *Auchenocarpa* has more in common with *Wedelia* and *Aspilia* than with the other species of *Zexmenia,* in which the achenes are never winged, and the pappus-awns are continuous with the edges of the achenes.

For the purposes of the *Flora Novo-Galiciana,* and pending a revision of the entire group under discussion, I have treated under the name *Wedelia* all the species having the achenes constricted into a short neck bearing the pappus, which is in the form of a toothed or lacerate cup, with or without one or two erect awns. The characters of winged vs. non-winged achenes, and fertile vs. sterile ray-flowers, are thought to be relatively insignificant in this group.

The following key contrasts the newly described *Wedelia cordiformis* and *W. simsioides,* and the other species referred to *Wedelia* in the *Flora Novo-Galiciana:*

1. Heads apparently discoid, sessile in small clusters of 2–5, terminating naked peduncle-like branches; disk-flowers 8–10 in a head. *Aspilia aggregata.*
1. Heads with conspicuous yellow, white, or purple rays, not clustered, individually pedunculate; disk-flowers 20–40 in a head, or much more numerous.
   2. Erect, harshly setose-hispid perennial herbs of marshy meadows, with a few large yellow-flowered heads; disk-flowers more than 100; leaves sessile or with broadly winged petiolar base; rays 13–18, sterile as far as known.
      3. Leaves ovate, sessile, cordate at base, finely denticulate; phyllaries 13–17 mm long, lance-ovate, with tapering tips. *W. cordiformis.*
      3. Leaves broadly ovate, with broad winged margins extending to the base of the petiole, irregularly and somewhat hastately toothed; phyllaries 8–9 mm long, elliptic-ovate, abruptly narrowed to obtuse apiculate tips. *W. simsioides.*
   2. Shrubs, or perennials woody at base, chiefly of upland habitats; disk-flowers 20–60; leaves petiolate, or rarely with petioles margined nearly to base; rays commonly 5–8, fertile or sterile.
      4. Low perennials woody at base, with several sprawling or prostrate stems up to 15–25 cm long; leaves 1.5–4 (–7) cm long, 0.7–1.5 (–2.3) cm wide; heads mostly solitary on peduncles 1–3 cm long; rays sterile as far as known.
         5. Rays white; leaves flat, often obtuse at apex; involucre 8–12 mm high. *W. grayi.*
         5. Rays probably yellow; leaves rugose and revolute-margined, commonly acute at apex; involucre 6–7 mm high. *W. mexicana.*
      4. Erect, woody-based perennial herbs, or shrubs, mostly 0.5–1 m high or more, commonly branched, with several or many long-peduncled heads; leaves commonly more than 5 cm long; rays fertile or sterile.
         6. Leaves mostly elliptic or lanceolate, acute or tapering at base, 3.5–8 times as long as wide, revolute and often appearing entire; rays sterile as far as known.
            7. Rays yellow or occasionally white. *W. rosei.*
            7. Rays purple. *Aspilia xylopoda.*
         6. Leaves mostly ovate, rounded at base and sometimes with winged margins extending below the blade nearly to the base of the petiole; blades mostly 1.5–2.5 times as long as wide, variously toothed; rays sterile or fertile.
            8. Shrub often 1–2 m high; involucre 8–11 (–16) mm high; disk-corollas 5–7 mm long; anthers 2–2.5 mm long; disk-achenes 4.5–5 mm long; rays sterile. *W. acapulcensis.*
            8. Herbaceous perennial woody at base only, often 50–75 cm high; involucre 5–6 mm high; disk-corollas 4 mm long; anthers 1.5 mm long; disk-achenes 2.5–3.5 mm long; rays fertile, the achenes broadly 2-winged. *W. fertilis.*

Aspilia (?) aggregata Greenm. Proc. Am. Acad. 39: 102. 1903.

Nothing like this has been found since the original collection (*Rose 3029!*), which was an over-ripe and incomplete specimen. I suspect it represents an abnormal form of *Wedelia rosei,* which is known from a number of localities in the same general region.

Wedelia cordiformis McVaugh, sp. nov.

Herba perennis grossa erecta, hispido-aspera, metralis, caulibus paucis, basi 5–7 mm crassis, superne pauciramosis, purpureo-maculatis pilisque basi crassis, erectis,

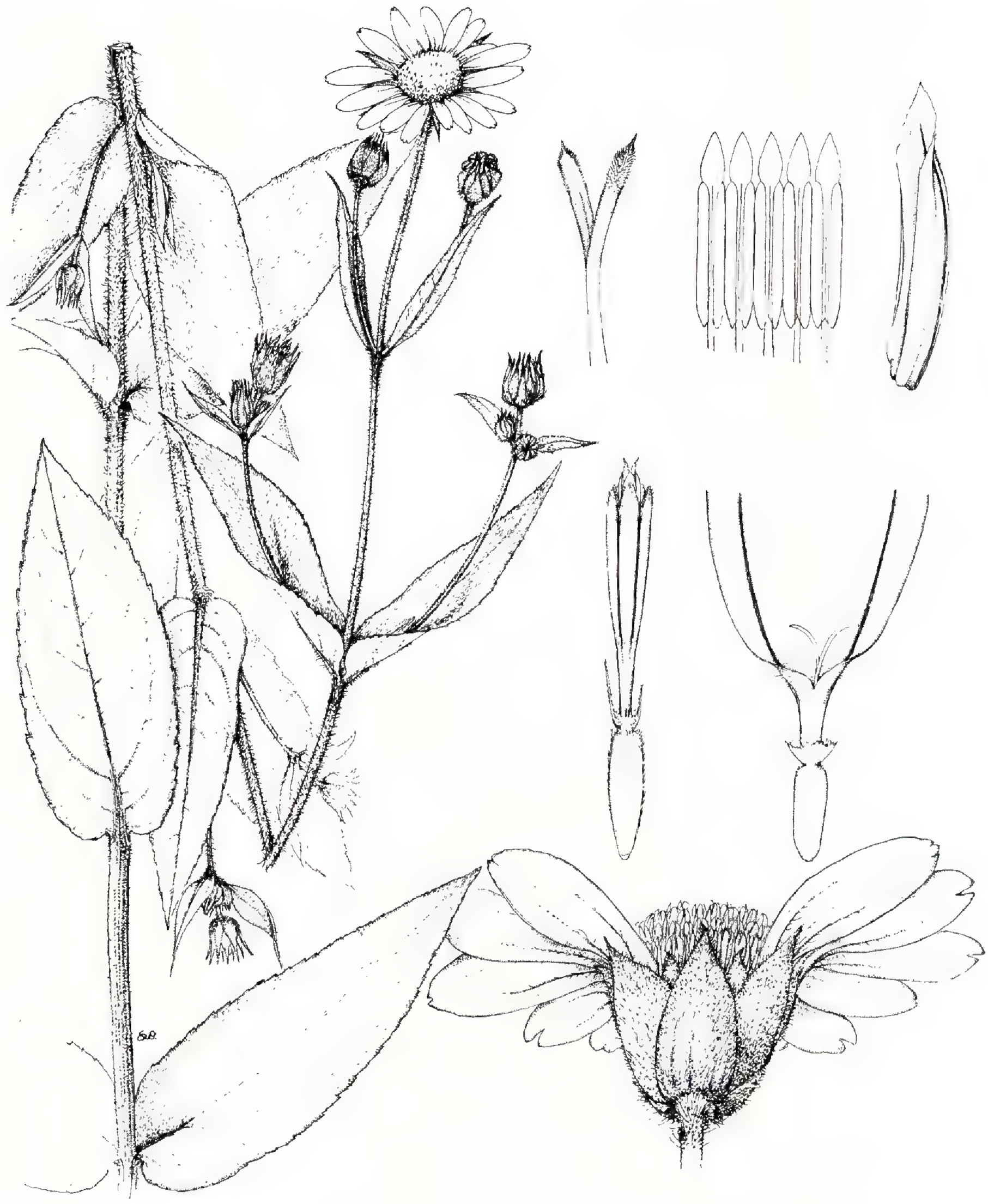

FIG. 49. *Wedelia cordiformis* (*McVaugh 17266,* type). Upper part of a flowering plant, X ½; flowering head with some rays removed, X 1.5; disk-corolla, base of ray-corolla, and immature achenes, X 5; pale, X 5; anthers and style-tips, X 7.5.

attenuatis scabridulis 1–2.5 mm longis grosse hispidis; pili in ramis pedunculisque numerosissimi, cum pilis multo minoribus crispatis glandulosisque immixti; phyllaria pilis plusminusve appressis dense hispida; folia crassa rigidaque, supra pilis rigidis acutis ascendentibus scabra, subtus pilis minutis uncinatis vel capitatis, et in venis pilis crassioribus obsita; laminae sessiles, lanceo-ovatae, 7–10 cm longae (vel superiores breviores), 2–4 cm latae, 2.5–3-plo longiores quam latiores, apice anguste acutae vel acuminatae, basi cordatae auriculis rotundatis, penninerves sed nervis 2 validis medianis ascendentibus, marginibus utroque latere dentibus 20–30 irregulariter non profunde serratis; capitula pauca speciosa 4–5 cm lata (radiis extensis mensa), terminalia, vel ad apices ramorum superiorum ascendentium bina vel terna, pedunculis 5–12 cm longis,

1.5 mm crassis; involucrum hemisphaericum 13–17 mm altum, basi subtruncatum; phyllaria 15–20 subaequalia, exteriorum ca 3 sterilibus ovatis 4–5 mm latis, apicibus acutis attenuatis; phyllaria cetera achaenia subtendentia, eorum 5 vel plusquam 5 foliaceis, late elliptico-ovatis, acuminatis, 4.5–7 mm latis, intima minora membranacea; flores radii feminei 13–17, ut videtur steriles, ligulis flavis oblongis 1.5–2 cm longis, 5 mm latis, apice emarginatis, basi valde binervatis, nervis 2 atropurpureis, tubo 2 mm longo; styli ramuli filiformes 2 mm longi, apice attenuati; flores disci 125–150, corollis flavis inter lobis atrovenosis, vel distaliter purpurascentibus, 7 mm longis, anguste tubuloso-infundibuliformibus, tubo 3 mm longo, lobis acutis triangularibus 0.5–0.7 mm longis hispidulis, intus papillosis; antherae brunneae 2.2 mm longae, basi auriculatae, appendicibus acutis cochlearibus 0.6 mm longis; styli ramuli 1.5 mm longi, intus applanati, extus ad apicibus breve subulatis hirsutuli; achaenia matura non visa, radii glabra, disci pilosa; pappus coroniformis 0.5–1 mm altus scariosus, erosus vel laceratus, ad achaenii apicem collo brevi suffultus, disci achaenii arista adaxiali debili 1–1.3 mm longa munitus; paleae 7–9 mm longae, cymbiformes, carinatae, carina basi purpureo-venosa, apicibus breviacutis.

JALISCO: Poorly drained meadow in grassland, 11–12 km WNW ot Tototlán toward Zapotlanejo, elev. ca 1800 m, beginning to flower 24 Aug 1958, *McVaugh 17266* (MICH, type). Otherwise unknown.

Wedelia fertilis McVaugh, nom. nov. *Lipochaeta strigosa* DC. in DC. Prodr. 5: 610. 1836, not *Wedelia strigosa* Hook. & Arn., 1841. *Zexmenia strigosa* (DC.) Sch. Bip. in Seem. Bot. Voy. Herald 306. 1856.

Habitu characteribusque vegetativis a *Wedelia acapulcensi* vix differt, sed planta herbacea 50–75 cm alta est, non frutex; involucrum 5–6 mm altum (non 8–16 mm ut in *W. acapulcensi*); disci corollae 4 mm longae (non 5–7 mm); antherae 1.5 mm longae (non 2–2.5 mm); achaenia disci 2.5–3.5 mm longa (non 4.5–5 mm); radii fertiles, achaeniis late bialatis.

On the Pacific slope of Mexico from Nayarit to Oaxaca (Tehuantepec, *Andrieux 313*, G-DC!, type), Chiapas and Central America; Yucatán Peninsula.

The full extent of the range of this plant is not known as many specimens lack mature achenes. Specimens from eastern Mexico are often identified as *Wedelia [Zexmenia] hispida* H.B.K., or as *Wedelia parviceps* Blake, a Central American species with very small, about 9-flowered, disk. A revision of the *acapulcensis-fertilis-hispida* complex is much needed.

Wedelia grayi McVaugh, nom. nov. *Aspilia albiflora* A. Gray, Proc. Am. Acad. 22: 425. 1887, not *Wedelia albiflora* Hiern, 1898.

Wedelia mexicana (Sch. Bip.) McVaugh, comb. nov. *Wirtgenia mexicana* Sch. Bip. in Seem. Bot. Voy. Herald 304. 1856. *Aspilia mexicana* (Sch. Bip.) Hemsl. Biol. Centr. Am. Bot. 2: 171. 1881.

Wedelia rosei (Greenm.) McVaugh, comb. nov. *Aspilia rosei* Greenm. Proc. Am. Acad. 40: 39. 1904. *Aspilia angustifolia* A. Gray, Proc. Am. Acad. 22: 425. 1887, not *A. angustifolia* Oliver & Hiern, 1877. *Aspilia angusta* Blake, Contr. U.S. Nat. Herb. 22: 619. 1924.

Wedelia simsioides McVaugh, sp. nov.

Herba perennis (?) grossa erecta aspera metralis, superne sparsim ramosa; caules asperi, pilis basi crassis valde inaequalibus rigidis erectis attenuatis ad 1–1.5 mm longis hispidi, pilis minutis glandulosis immixtis; pedunculi dense hispidi; phyllaria dense brevistrigosa; folia omnia opposita, scabra, rigida, pilis magnis rigidis pilisque parvis uncinatis vel capitatis obsita; laminae sessiles, triplinerves, supra basin petioliformen productam late alatam 1–2 cm longam, 6–15 mm latam, late ovatae vel subhastatae;

FIG. 50. *Wedelia simsioides* (*McVaugh 18735,* type). Upper part of a flowering plant, X ½; flowering head with some rays removed, X 2; corollas, disk-achene, and pale, X 5; anthers and style-tips X 5.

laminae pars ovata 3–8 cm longa, 2–7.5 cm lata, acute acuminata, versus basin rotundata, marginibus grosse, irregulariter, acuteque dentatis, vel dentibus proximalibus majoribus prominentibus; capitula crassa, brevia, ca 2.5 cm lata (radiis extensis mensa), terminalia vel ad apicibus ramorum paucorum superiorum ascendentium bina vel terna, pedunculis (2–) 5–15 cm longis, 1–1.5 mm crassis suffulta; involucrum hemisphaericum 8–9 mm longum; phyllaria appressa 20–22, rigida, foliacea vel intimorum 5–8 membranacea, mediana exterioraque elliptico-obovata, 2.5–4.5 mm lata (extima angustiora), ad apices obtusos apiculatos abrupte angustata; flores radii 15–18, feminei, steriles, ligulis aureis basi atrovenosis, ellipticis, 8–10 mm longis, 3–4.5 mm latis, tubo 3.5 mm longo; styli ramuli filiformes 2.5 mm longi, apicibus attenuatis; ovarium sterile

lineare 3 mm longum, pappo ex squamellis laceratis aristisque 3 debilibus minus quam 1 mm longis constanti; flores disci conferti ca 150; corollae aureae 8 mm longae, anguste tubuliformes, inter lobos lineatae, lineis atropurpureis, tubo gracili 4 mm longo, lobis pallidis triangularibus 1 mm longis intus papillosis; antherae brunneae 2.8 mm longae, basi auriculatae, appendicibus coriaceis ovatis cochlearibus 0.7–0.8 mm longis; styli ramuli filiformes, intus applanati, extus et in appendice subulato hirsutuli; achaenia disci 3.5–4 mm longa, ambitu cuneata vel obovata, pilis cupreis sericeo-strigosa, anguste marginata sed vix alata, apice sub-biauriculata, auriculis truncatis; pappus cyathiformis sessilis (collo obsoleto) 0.7–0.8 mm alto minute laciniatus, aristis 2 debilibus inaequalibus, arista longiore 1 mm longa; paleae scariosae 7–8.5 mm longae, ante postque anthesin involucrum superantes, anguste carinatae (carina basi purpureo-nervata), apicibus planis acutis erosis 2 mm longis, rigidis, lanceolato-ovatis saepe purpureis; receptaculum fere planum 5 mm latum.

NAYARIT: Marshy meadows among hills in oak zone 6–8 km N of Compostela, elev. 800–900 m, 5 Sep 1960, *McVaugh 18735* (MICH, type). Otherwise unknown.

Aspilia xylopoda Greenm. Proc. Am. Acad. 40: 40. 1904.

Known only from extreme southern Durango (*Rose 2260!*, lectotype) and adjacent Nayarit, at elevations between 2000 and 2500 m. This may be merely a purple-flowered form of *Wedelia rosei.* Apparently the purple- and yellow-flowered plants are associated in nature, as Rose's no. 2245 includes both. Field-studies in the rather inaccessible region where Jalisco, Nayarit, Durango and Zacatecas adjoin are needed to clarify the status of *A. xylopoda.*

Zaluzania augusta (Lag.) Sch. Bip., var. **rzedowskii** McVaugh, var. nov.

Frutex 1–2-metralis, var. *augustae* similis sed pubescentia et globulis resinosis amplius praeditus, et characteribus aliis differt:

Folia utrinque griseo-veneta, supra vix viridiora; phyllaria herbacea pilis brevibus (foliorum pilis similibus) dense cinereo-pubescentia; paleae prope apices dense pubescentes et globulis resinosis instructae; corollae lobi antherarum appendicesque resinoso-globuliferi; folia ramorum florentium saepe obovata vel spathulata, superiora manifeste minora, corymbis versus apices fere aphyllis, ramulisque ultimis interdum ebracteatis; pedunculi 1–3 cm longi; ligulae pubescentes; flores disci 60–90, tubo corollae laxe piloso, glandulari; achaenia radii ad 2 mm longa distaliter pilosa, pappo nullo vel ex setis paucis brevibus constanti; paleae 3.5–4 mm longae, brevi-acutae, dorso et ad apicibus pilosae.

ZACATECAS: Rocky oak-covered hills ca 25 km E of Huejuquilla el Alto, near the road between Valparaíso, Zac., and Mezquitic, Jal., elev. ca 2000–2100 m, 4–5 Sep 1958, *McVaugh 17673* (MICH, type); 12 Sep 1966, *Anderson & Laskowski 3623.*

JALISCO: Arroyos del Agua, 10 km NW of Huejuquilla, 1500–1550 m, 2 Nov 1963, *Rzedowski 17629, Feddema 2377.*

In typical *Zaluzania augusta,* which is known to range from near the City of Aguascalientes to Hidalgo, the pales are glutinous but not strongly pubescent, and the pappus in the ray-flowers (at least in Nueva Galicia) usually consists of short, irregular, somewhat united subulate setae 0.6–0.8 mm long, or of 3 awnlike scales and intervening setae. In var. *rzedowskii* the pappus is pretty consistently wanting.

Zexmenia helianthoides (DC.) A. Gray, var. **jaliscana** McVaugh, var. nov.

Folia supra modice aspera (non scabra ut in var. *helianthoide*), e loco supra basin 5–10 mm 3-nervata (non e basi 3-nervata); ramulorum inflorescentiaeque pili pallidi plusminusve appressi (rami non sordide hirsuti).

JALISCO: In oak woodlands below the pass, 16–20 km SW of Autlán, elev. 1000–1500 m, 1 Nov 1962, *Cronquist 9778* (MICH, type), 21 Nov 1959, *McVaugh & Koelz 872;* in deciduous forest ca 30 km SW of Autlán, elev. 300 m, 8 Apr 1949, *McVaugh 10197;* Tecalitlán, Sierra del Halo, in pine forest, elev. 2000–2200 m, 28–30 Nov 1959, *McVaugh & Koelz 1207;* Sierra de los Corales, ca 15 km E of Pihuamo, elev. 1200–1300 m, 24 Oct 1963, *Feddema 2213.*

Typical *Zexmenia helianthoides* in a plant chiefly of the hills bordering the Balsas valley, ranging from western Michoacán to Morelos and Guerrero. The type (*Karvinski s.n.* in herb. G-DC!) came from between Sultepec and Mina de Cristo, Edo. de Mexico.

The group of *Zexmenia* that includes this species and *Z. michoacana* Blake is a difficult one taxonomically, and is in need of revision. In *Z. michoacana* the involucre is about 7–10 mm long as against 11–17 mm in *Z. helianthoides,* and the disk flowers are about 40–50 (–75?) in a head, as against 75–100 (–200?).

Zinnia angustifolia H.B.K., var. **greggii** (Rob. & Greenm.) McVaugh, comb. nov. *Zinnia greggii* Rob. & Greenm. Proc. Am. Acad. 32: 16. 1896.

Traditionally *Zinnia angustifolia* has been described as an annual with orange rays, and *Z. greggii* as a perennial with white or yellow rays. In Nueva Galicia there appear to be two populations that are geographically overlapping, both perennial (but often flowering the first year and appearing annual), morphologically indistinguishable except for the color of the rays. Var. *angustifolia,* with bright orange rays, is the more widely distributed (southern Sonora to Jalisco, Michoacán, Aguascalientes and San Luis Potosí), but is replaced to some extent, on the Pacific Slope from Sinaloa to Michoacán, by the var. *greggii* with white or cream-colored rays that may be distinctly yellow when dry. Plants with white rays and those with orange rays are sometimes found growing together.

Tribe V. Inuleae

Gnaphalium attenuatum DC., var. **sylvicola** McVaugh, var. nov.

Folia 5–10 (–15) cm longa, (3–) 5 (–8) mm lata, (10–) 15–20-plo longiora quam latiora, supra laevia lucidaque, viridia et fere glabra sed pilis gracillimis arachnoideis paucis plerumque persistentibus; capitula pallide rosea, vetustiora saepe straminea vel pallide brunnea; phyllaria interiora 12–13; flores hermaphroditi 3–7, corollis 3 mm longis vel brevioribus; a var. *attenuata* foliis angustioribus supra non asperatis, capitulis roseis non albo-flavidis nec albo-brunneis, phyllariis 12–13 non 13–21, differt.

DURANGO: Between Durango and Mazatlán, humid oak-pine forest near the Sinaloa border, elev. 2100–2300 m, 23 Mar 1951, *McVaugh 11581.*

JALISCO: Cerro de Tequila, pine forest, elev. 1700 m, 23 Dec 1967, *L. M. Villarreal de Puga 1088;* San Sebastián, elev. 1425 m, 3 Jan 1927, *Mexia 1359;* Sierra de Cuale, SW of Talpa de Allende, elev. 1800–2250 m, 19–21 Nov 1952, *McVaugh 14283* (MICH, type); 25–30 km SE of Autlán, near summits between El Chante and Cuzalapa, elev. 2000–2250 m, 19–22 Mar 1965, *McVaugh 23105;* Sierra del Tigre, S of Mazamitla, pine forest, 2100–2200 m, 10 Nov 1959, *McVaugh & Koelz 445.*

MEXICO: Valle de Bravo, 28 Jan 1943, *Dodds & Simpson 34;* Sultepec, 27 Oct 1935, *Hinton 8390.*

MORELOS: Sierra de Tepoxtlán, 7500 ft, 13 Feb 1907, *Pringle 13885.*

GUERRERO: Dist. Mina, Petlacala, 1850 m, 15 Dec 1937, *Mexia 8962;* Chiriagua, 1340 m, 18 Nov 1936, *Hinton 9845.*

The var. *attenuatum* appears to occupy much the same range as that of var. *sylvicola,* but it is found in somewhat drier habitats. Both are unusual for the genus in being forest plants, not especially weedy but occupying clearings or open places in oak-pine or pine-fir forest.

The var. *sylvicola* in appearance suggests an intermediate between *G. attenuatum* var. *attenuatum,* in which the leaves are 4–8 (–15) mm wide, and *G. greenmanii* Blake, in which the leaves are 2–3 mm wide and 30–50 times as long as wide.

Gnaphalium semilanatum (DC.) McVaugh, comb. nov. *Gnaphalium oxyphyllum β semilanatum* DC. in DC. Prodr. 6: 225. 1838.

The type-material of *Gnaphalium oxyphyllum* DC. (G-DC!) consists of several specimens collected by Méndez near Villalpando, Guanajuato. The plants are somewhat

woollier than our material from Nueva Galicia, but are also very glandular and appear to represent the same species that I have called *oxyphyllum.* In most specimens from Jalisco and Aguascalientes the leaves are green and nearly hairless on both sides or thinly woolly beneath when young, and the middle and lower stems are glandular-pilose. In *G. semilanatum* the leaves are strongly bicolored, white beneath with a feltlike tomentum; the stem is similarly tomentose, not glandular. Most of the species of *Gnaphalium* are either strictly glandular or non-glandular, and I have accordingly separated these two rather similar plants, pending further investigation of their relationships.

Gnaphalium vulcanicum I.M. Johnst., var. **monticola** McVaugh, var. nov.

Annua vel biennis saepe 0.5–1 m alta vel altior; folia ad 50–75, caulinia plerumque angusta, attenuata; caules foliaque plerumque manifeste glandulosa; capitula 4.5–7 mm longa, 60–80-flora, brunnea vel flavo-brunnea; habitat silvas montanas, alt. 2500–3500 m.s.m.

JALISCO: Cerro de Tequila, in oak forest, elev. 2400–2800 m, 14 Sep 1967, *McVaugh 23922, 23923;* Nevado de Colima, SE slopes in fir forest, elev. 2850 m, 2 Apr 1951, *McVaugh 11706;* 25–30 km SE of Autlán, pine forests near summits between El Chante and Cuzalapa, elev. 2750 m, 20–21 Mar 1965, *McVaugh 23126* (MICH, type).

MICHOACAN: NW of Ciudad Hidalgo, mountains W of Cerro San Andrés, pine-fir forests, elev. 2850–3000 m, 21 Mar 1949, *McVaugh 9985.*

GUERRERO: Mpio. de Tlacotepec, Cerro Teotepec, pine-fir forest, elev. 2900 m, 29 Jan 1965, *Rzedowski & McVaugh 240.*

MORELOS: Tres Marías Mts., 9500 ft., 7 Nov 1903, *Pringle 11531.*

GUATEMALA: Chimaltenango, Santa Elena, 2400–2700 m, 22 Jan 1933, *Skutch 191.* Quezaltenango, 2 km W of Quezaltenango, 3 July 1960, *King 3187.*

The var. *vulcanicum* is a plant of open places near timberline and above, at elevations from 3000 to 4000 m; the flowering stems are usually 30 cm high or less, the cauline leaves mostly 20 or fewer, merely acute, the stems and leaves woolly but seldom manifestly glandular; the heads are 6.5–8 mm long, the flowers 125–200 in a head. Plants of var. *monticola* have somewhat the aspect of *Gnaphalium oxyphyllum* DC., but in that species the heads are white and only 35–50-flowered, 4–4.5 mm long, the perfect flowers 2–7 (not 10–20).

Tribe VI. Mutisieae

Perezia glomeriflora (A. Gray) McVaugh, comb. nov. *Gochnatia glomeriflora* A. Gray, Proc. Am. Acad. 19: 57. 1883. *Perezia capitata* S. Wats. Proc. Am. Acad. 25: 156. 1890. *?Perezia collina* S. Wats. Proc. Am. Acad. 26: 144. 1891.

This plant seems obviously closely related to several other species of *Perezia* from the same region (e.g. *P. dugesii* A. Gray, *P. simulata* Blake), but not particularly closely to the other Mexican species of *Gochnatia,* to which genus it has been assigned because most of the corollas are equally 5-lobed, not with one broad lobe and 2 narrow ones as usual in *Perezia.* In fact the corollas in *P. glomeriflora* are not always 5-lobed; sometimes they are typically perezioid (with one broad and 2 narrow lobes), or occasionally they may have one narrow lobe and 2 broad ones. Union and non-union of corolla-segments are under relatively simple genetic control in many plant genera, and it seems likely that they are here also. Curiously enough, although *P. glomeriflora* was excluded from *Perezia* in Bacigalupi's revision of the genus, the very similar *P. collina* was admitted as a true *Perezia* with an "anomalous" corolla.

Perezia hooveri McVaugh, sp. nov.

Herba perennis 1–1.5-metralis, erecta, foliosa, subglabra, caulibus purpureis ad 6 mm crassis vel crassioribus, laevibus glabrisque vel pilis paucis instructis, ramis pedunculisque in axillis foliorum bractearumque barbatis, ceterum glabris; folia pro

FIG. 51. *Perezia hooveri* (*McVaugh 11750,* type). Flowering branch, X ½; flowering head X 2.5; corolla, achene, and anthers, X 5.

genere tenuia et inconspicue venosa, supra asperula, marginibus scabris, subtus pilis parvis paucis in venis exceptis glabra; phyllaria pedunculique bracteae pauciciliatae, non glandulosae; folia principalia caulinia elliptico-obovata, sessilia amplexicauliaque, 20–30 cm longa, 6–12 cm lata, ca 2.2–3-plo longiora quam latiora, e medio ad apicem acutum vel breviacuminatum et ad basin oblongam 3–4.5 cm latam angustata, auriculis basalibus rotundatis 1–1.5 cm longis, marginibus grosse dupliciterque dentibus acutis 1–3 mm altis munitis; ramorum florentium majorum folia multo minora, angustiora, oblongo-elliptica vel superiora ovata, (4–) 8–15 cm longa, 2–4 cm lata, basi amplectentia, apicibus angustis acutis exceptis spinuloso-denticulata; inflorescentiae ramulorum bracteae foliaceae, ovato-cordatae, 1–4 cm longae, integrae vel vix denticulatae; caulis ut videtur inferne simplex, parte superiore diffuse ramosa, ramis majoribus divaricatis 30–60 cm longis, 5–6-plo furcatis, capitulis ca 2 cm longis, angustis plurimis, in pedunculis filiformibus subulato-bracteatis 1–2.5 cm longis suffultis; involucrum 10–12 mm longum, anguste campanulatum vel obconicum, phyllariis ca 20, purpurascentibus, vix basi excepta imbricatis, medianis exterioribusque gradatim brevioribus, ellipticis, acutis, ad 1.5 mm latis, extimis brevissimis laxe patentibus; phyllaria intima 5 plerumque manifeste longiora 9–11 mm longa, angusta elliptica vel sublinearia, 1–1.3 mm lata, tenuia vix coriacea, ad apices acutissimos obscureque mucronatos attenuata; capitula 11-flora; corollae roseae vel purpurascentes, 11.5–12.5 mm longae, tubo obscure glanduloso-puberulenti, lobo exteriore 4.5 mm longo, 1.5 mm lato, lobis interioribus 0.4 mm latis, interdum connatis; antherae apicibus sterilibus purpurascentibus inclusis 4–4.5 mm longae, appendicibus incurvatis, caudis 1.8–2.5 mm longis; styli ramuli 1.5 mm longi applanati, papillosi, apicibus spathulatis, truncatis; achaenia viridi-brunnea ca 7 mm longa, compresso-fusiformia, ad rostrum brevem attenuata, prope medium 1.2 mm lata, paucinervia, copiose glandulosa; pappi setae biseriatae 9–12 mm longae, alboflavidae, rigidiusculae sed gracillissimae; receptaculum glabrum, alveolatum, alveolarum marginibus dentatis.

Species comiti adjutorique David Beall Hoover (1926–), nunc washingtonensi, qui mecum anno 1951 per terram mexicanam lustravit et plantas collectavit, nominavi.

JALISCO: Nevado de Colima, SE slopes in pine-oak-fir forest, elev. 2400 m, 3 Apr 1951, *McVaugh 11750* (MICH, type); SE of Autlán, barranca-forest above Ahuacapán, elev. 1500–2200 m, 22–23 Nov 1959, *McVaugh & Koelz 1011.*

Superficially like *Perezia patens* A. Gray, but in the latter the main flowering branches have a strong central axis, whereas in *P. hooveri* they are repeatedly forked. In *P. patens* the phyllaries are 25–35, overlapping in several series, and the middle ones are 2–2.5 mm wide, broadly elliptic to ovate or obovate, rounded or abruptly acuminate.

Tribe VII. Senecioneae

Liabum simile McVaugh, sp. nov.

Frutex arcuatus gracilis 3–4 m altus, ramis longis subscandentibus, caule striato, initio floccoso-tomentoso; inflorescentiae rami, pedunculi phyllariaque pilis gracilibus arachnoideis pilisque glanduliferis immixtis obsita, pilis glandulosis majoribus ex parte apicibus ampliatis cylindricis instructis; folia deltoideo-hastata, 6–13 cm longa lataque, supra glabrescentia sed scabridula, subtus venis principalibus exceptis perpetuo albotomentosa; laminae acutae vel breve acuminatae, basi late obtusae vel truncatae, majores saltem hastatae lobis acutis, marginibus sinuatis et cuspidato-denticulatis, in petiolos 3–7 cm longos cuneatim decurrentibus; inflorescentia terminalis ad 15 cm longa lataque vel longior latiorque, paniculiformis, ramis lateralibus ca 2-plo ramosis, 10–15-cephalis, infimis exceptis per bracteas oblanceolatas coriaceas 1–2 cm longas

subtentis; capitula discoidea; involucrum 8–9 mm longum, late campanulatum vel hemisphaericum; phyllaria 25–30, pilis glandulosis pilisque gracilibus eglandulosis dense pubescentia, apicibus tomentulosa, exteriora manifeste gradatimque breviora; phyllaria interiora lanceolata, acuta, 1.3–2.5 mm lata; exteriora (extimis exceptis) similia sed ovata, acuta, basi striata, demum plusminusve squarrosa; flores 15–19; corollae albae, ca 10 mm longae, tubo breve 2 mm longo, in faucem anguste infundibuliformen sensim ampliato, lobis lanceolatis, 2.5 mm longis, sub anthesi recurvatis; antherae flavidae 3.5 mm longae; styli flavi vel aurantiaci, ramulis 1 mm longis; achaenia columnaria vel distaliter paullo ampliata, 3.5–4 mm longa, striata, pallide griseo-brunnea, plusminusve

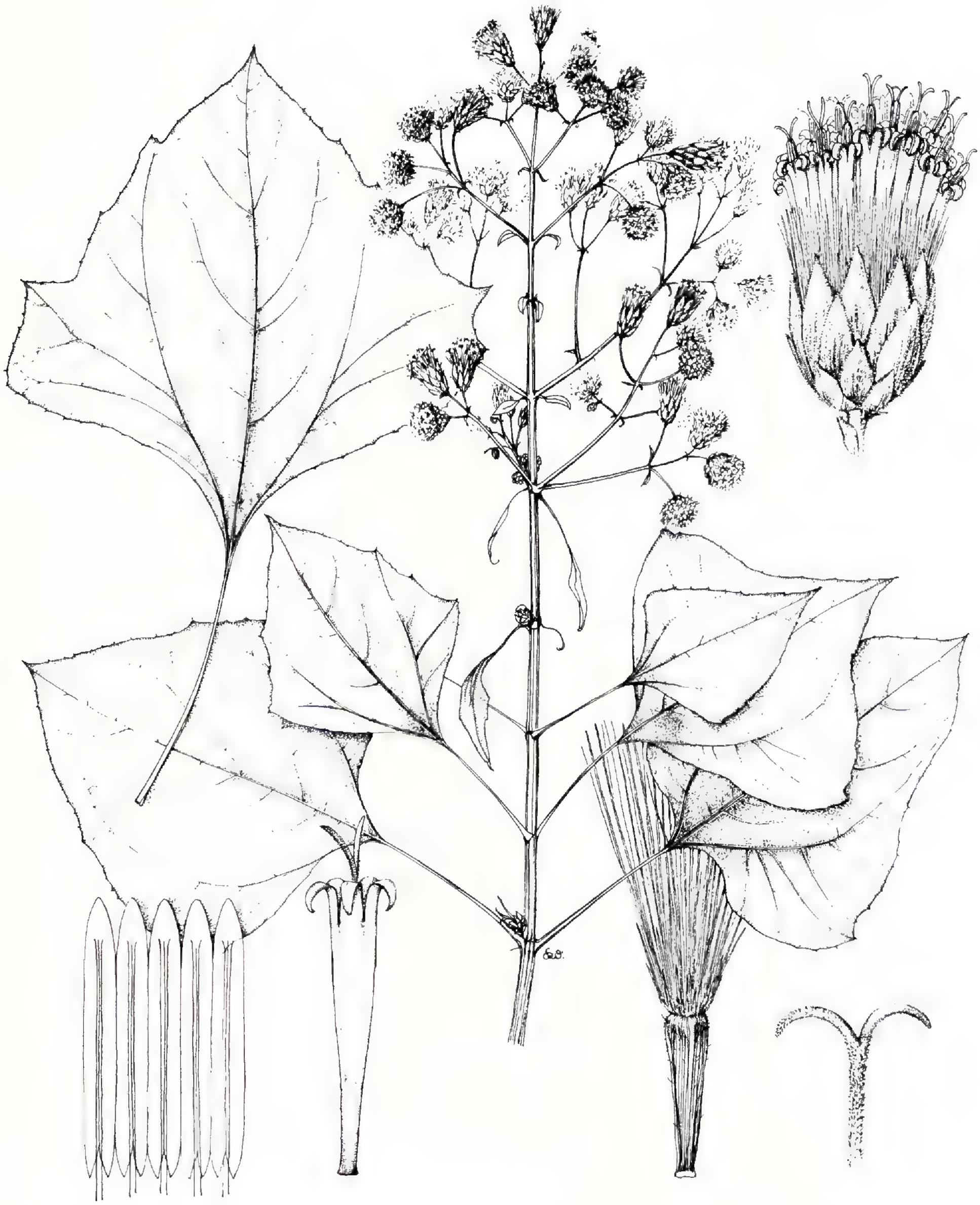

FIG. 52. *Liabum simile* (*Cronquist 9602,* type). Flowering branch and detached cauline leaf, X ½; flowering head, X 2.5; corolla, X 3.5; achene, X 5; style-tips, X 7.5; anthers, X 10.

breve pilosa et rare glanduloso-globulifera; pappi setae albo-flavidae 7 mm longae, squamellis 0.5–1 mm longis; receptaculum alveolatum, alveolarum marginibus hirsutulis.

NAYARIT: Depressions in lava flow, in shade of *Bursera* and other trees, ca 10 km NW of Ahuacatlán, elev. ca 1000 m, 4 Oct 1962, *Cronquist 9602* (MICH, type).

JALISCO: Tropical subdeciduous forest along Río Cuale, 3 km SE of Puerto Vallarta, elev. 50 m, 12 Nov 1963, *Feddema 2507.*

Superficially *Liabum simile* is much like *L. caducifolium* Rob. & Bartl., which is widespread near the Pacific coast from southern Jalisco to Guerrero, but in *L. caducifolium* the phyllaries are only 15–20, 5–6 mm long, the flowers are only 6–9 (–12) in a head, and the herbage lacks most of the pubescence characteristic of *L. simile,* including the coarse glandular hairs of the phyllaries and peduncles.

Pippenalia McVaugh, gen. nov.

Herba scaposa perennis, basi lanosa, scapis erectis 1–3, sulcatis, monocephalis, foliisque erectis longipetiolatis, peltatis, radiatim profunde lobatis; flores aurei; capitula multiflora, heterogama, vix vel haud calyculata; involucrum sub-biseriatum, phyllariis subaequalibus, linearibus vel lanceolatis, rotatis; receptaculum nudum; flores radii feminei, fertiles, ligulis conspicuis, tubo breve; flores disci plurimi, hermaphroditi, tubo quam fauce cylindrica multo breviore, lobis 5 ovatis, fauce dimidio brevioribus; antherae cum filamentis ca aequilongae, basi obtusae, apice appendicibus scariosis instructae; florum disci styli ramuli lineares, intus applanati, extus rotundati pubescentesque infra apices penicillati, apicibus obtusis nudis; achaenia late fusiformia vel obovoidea, glabra, 15–20-costata; pappus nullus.

Genus in honorem amici Richard Wayne Pippen (1935–), cui debetur "Mexican 'Cacalioid' genera allied to *Senecio* (Compositae)," dicavi.

Type: **Pippenalia delphinifolia** (Rydb.) McVaugh, comb. nov. *Odontotrichum delphinifolium* Rydb. Bull. Torrey Bot. Club 51: 419. 1924.

Montane oak or oak-pine forests, on rhyolites or other volcanic rocks, from Chihuahua to southern Zacatecas (*Rose 2390!* the type), Aguascalientes and northern Jalisco, at elevations of 2450 to 2700 m, flowering from July to September.

The type of *Odontotrichum delphinifolium* was in fruit only. Flowering material was first discovered on the Sierra del Laurel, near the border between Aguascalientes and Jalisco, in 1960. The large yellow heads, with long rays resembling those of a sunflower, seem to preclude the possibility that the plant belongs with any of the white-flowered senecioid genera, including *Odontotrichum.* The correct taxonomic position of the genus is still open to question. In habit the plants are very like those of what Pippen has called the "cacalioid" members of the Senecioneae; the styles are at least not unlike the senecioid type; the plump naked achenes suggest those of some members of the Heliantheae, but are unusual if not unique among the North American Senecioneae.

Senecio filaris McVaugh, sp. nov.

Arborescens 2-metralis, trunco ad 5 cm diametro, ramis crassis fragilibus medulla lamellata; foliorum cicatrices lunatae vel hippocrepiformes 5 mm latae, pallidae, erosae; planta fere glabra, foliis subtus ut videtur rare tomentosis, inflorescentiae basi bracteisque arachnoideis; folia (2 delapsa visa) ad apicibus ramorum fasciculata, longe petiolata, ca 8 cm longa, 12 cm lata, palmatim 5–7-lobata, lobis acutis triangularibus 2–3 cm altis, marginibus integris, basi non profunde cordata; inflorescentia post lapsum foliorum evoluta, terminalis, umbelliformi-corymbosa, 8–15 cm alta lataque, ramis valde ascendentibus 10–15 gracilibus simplicibus 2.5–12 cm longis, 0.5–1 mm crassis (terminalibus saepe manifeste crassioribus), quoque ramo capitula solitaria terminali (raro capitulis 2), bractea lineari sub-basali 1 cm longa vel breviore, et supra basin

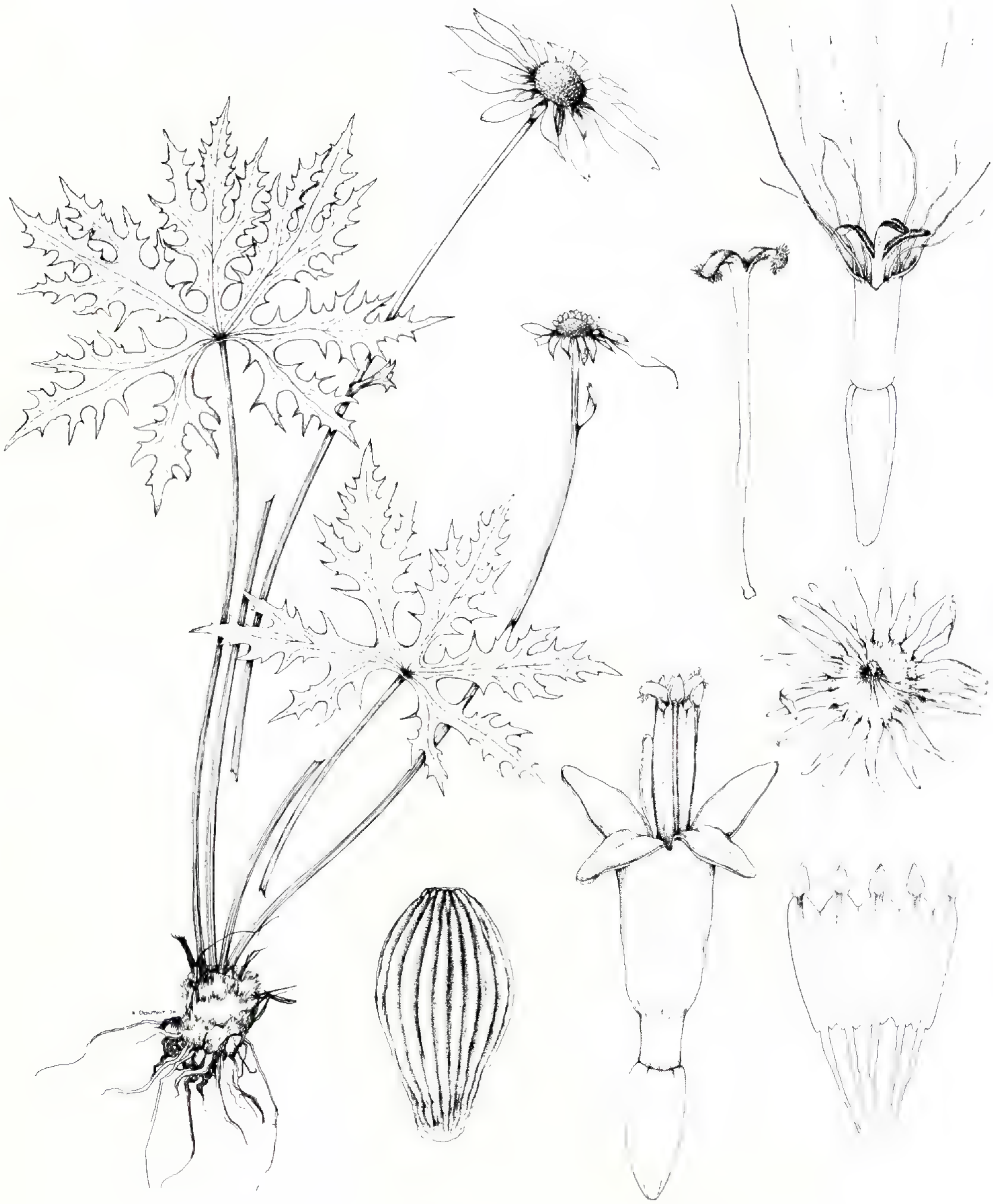

FIG. 53. *Pippenalia delphinifolia* (*McVaugh 18427*). Flowering plant, X 1/3; involucre from below, ca X 1; achene, X 5; disk-flower, base of 3-styled ray-flower, anthers, and style-tips, all X 6-2/3.

bracteis 1–3 minoribus, instructo; capitula aurea 1.5–2 cm alta, conspicue radiata; involucrum 12–13 mm longum, basi subtruncatum, bracteis accessoriis ca 3–5 filiformibus laxe patentibus subtentum; phyllaria ca 20 longitudine subaequalia, linearia vel distaliter paullo ampliata, apicibus acutis fimbriata, basi in siccitate gibba, exteriora 1.2–1.5 mm lata, interiora 2–2.5 mm lata, marginibus latis tenuibus; flores radii 13–14, ligulis 16–19 mm longis, 3–4 mm latis; flores disci ca 50–55, corolla 11 mm longa, angustissime infundibuliformi, tubo vix manifesto 2.5 mm longo basi campanulato, lobis ca 1 mm longis; antherae 4 mm longae; styli ramuli ca 2 mm longi,

apicibus ampliati hispidique; achaenia glabra, 4–6 mm longa vel longiora (matura non visa); receptaculum glabrum alveolatum.

COLIMA: Mountains in area of gypsum and slate, 17–18 km SSW of Colima, deciduous forest with *Bursera, Amphipterygium, Cyrtocarpa, Cephalocereus,* elev. 400–500 m, 7 Dec 1959, *McVaugh & Koelz 1550* (MICH, type). Otherwise unknown.

Evidently related to *Senecio praecox* (Cav.) DC., which appears to be unknown from Colima and southern Jalisco, and also to *Senecio bombycopholis* Bullock. From *S. praecox, S. filaris* differs in the much larger heads (50 or more disk-flowers as against 20 or fewer), which are solitary on long slender branches rather than corymbosely cymose and short-peduncled. From *S. bombycopholis, S. filaris* differs in the smaller heads, smaller and fewer flowers, narrower and shorter phyllaries, and more slender peduncles.

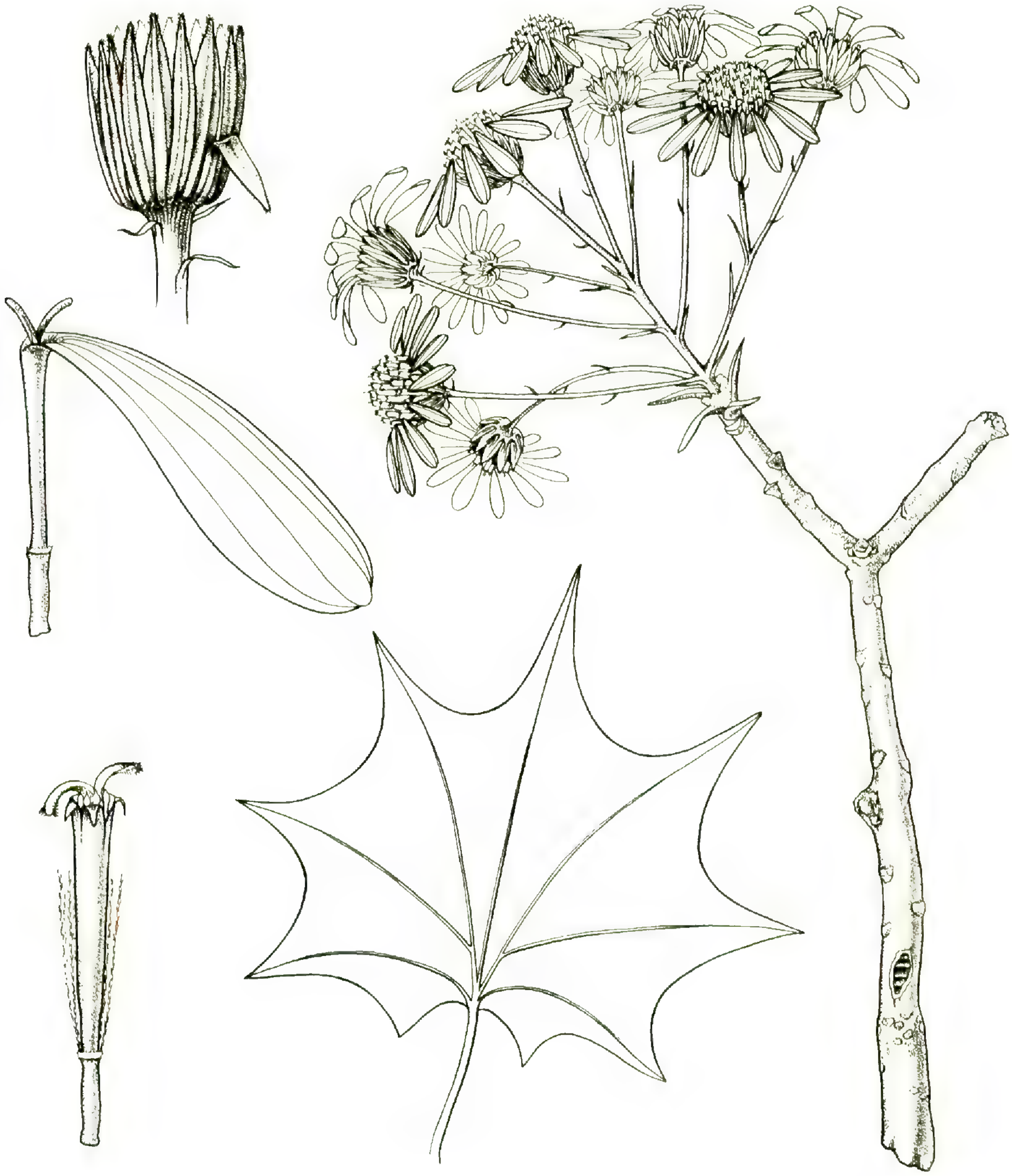

FIG. 54. *Senecio filaris* (*McVaugh & Koelz 1550,* type). Flowering branch and detached leaf, ca X ½; involucre, ca X 1.5; flowers, ca X 3. Drawn by Jeanne C. Koelling.

Senecio galicianus McVaugh, sp. nov.

Herba perennis gigantea 2–4-metralis, caulibus fistulosis foliosis, solitariis vel paucis, e caudicibus brevissimis lignosis oriundis, rare pubescens, inflorescentia arachnoideo-tomentulosa et pilis brevibus glanduliferis plerumque instructa, foliis glabrescentibus sed praecipue subtus in venis per bases pilorum multicellularium persistentes paullo asperatis; folia palmatim valde lobata, ambitu ovata vel late oblonga vel suborbiculata, principalia usque ad 30–35 cm longa lataque (sub inflorescentiam saepe 18–25 cm longa), lobis ca 9 acutis, deltoideis vel ovatis, stellatim dispositis vel ascendentibus 3–8 cm altis (vel loborum pari infimo 1–2 cm alto); laminae plerumque late sed non profunde cordatae, marginibus calloso-denticulatis (vel foliorum majorum dentibus acutis angustis ad 5 mm longis vel longioribus sublaceratis), petiolis 12–20 cm longis suffultae, venis subpalmatim dispositis; venarum paria 3–5 prope laminae basin oriunda, venis ad 5–10 mm distantibus; inflorescentia terminalis 30–100 cm longa, paniculiformis, ramis compositis plurimis ad 30–50 cm longis; rami inferiores foliis deminutis 10–20 cm longis subtenti, superiores bracteis foliaceis subsessilibus; capitula plurima, parva, 7–9 mm longa, radiata, flava vel aurea, 3–4 mm crassa, 10–30 prope ramorum apices in fasciculis umbelliformibus conferta, pedunculis bracteatis 5–10 mm longis, bracteis filiformibus; involucrum campanulatum, calyculo appresso subtentum, bracteis accessoriis lineari-subulatis ca 5–8, brevissimis vel longioribus ad 4.5 mm longis; phyllaria 10–13 subaequalia 3.5–5 mm longa, apicibus pubescentibus exceptis glabra, exteriora acuta linearia 0.4–0.6 mm lata, interiora tenuimarginata ad 1.5 mm lata; flores radii 5–8, ligulis 3.5–4.5 mm longis, 1.5–2 mm latis; flores disci 9–12, corollis 6 mm longis, tubo 2 mm longo, lobis triangularibus 1 mm longis; antherae appendicibus inclusis 2–2.3 mm longae; styli ramuli plus quam 1 mm longi, apice ampliati setosique; achaenia pallida fere glabra 2–2.5 mm longa, annulo distali ampliata; pappi setae 5 mm longae, apicibus vix vel haud ampliatis; receptaculum alveolatum, alveolis dentatis.

JALISCO: Ca 40 km W of Ayutla, mountains in mixed fir forest between San Miguel de la Sierra and El Carmen, elev. 2000–2150 m, 29 Nov 1960, *McVaugh 21560;* 3 Nov 1962, *McVaugh 22017* (MICH, type); SE of Autlán, 6–15 km SE of Ahuacapán, pine forest, ca 2000 m, 22–23 Nov 1959, *McVaugh & Koelz 978;* 25–30 km SE of Autlán, 2 km E of summits between El Chante and Cuzalapa, 2000–2250 m, 19–22 Mar 1965, *McVaugh 23104;* Nevado de Colima, NW slopes, oak-pine forest, elev. ca 1830 m, 31 Oct 1962, *Cronquist 9767.*

Although treated by E. S. Gibson (mss.) as a variety of *Senecio roldana* DC., this plant seems to have relatively little in common with that species. *S. roldana* is a characteristic plant of steep slopes in pine-oak forest, whereas *S. galicianus* is more at home in the slightly higher and more humid area where the dominant trees are pines and firs. The heads in *S. roldana* are consistently fewer and larger, on stouter, shorter, peduncles; the disk flowers are more numerous, the anthers larger; the inflorescence in *S. roldana* is coarsely branched and the heads tend to become aggregated in distinct rounded glomerules of 15–50 heads each, whereas in *S. galiciana* the slender branches tend to fork and the heads to become loosely aggregated at the periphery of a large rounded panicle. The most obvious difference between the two species is in the pubescence, which in *S. galicianus* is inconspicuous or almost wanting, whereas in *S. roldana* it usually forms a dense floccose or felty tomentum. In Nueva Galicia the heads of *Senecio roldana* are consistently discoid.

It is possible that *Senecio galicianus* is a synonym of *S. kerberi* Greenm., of which the type and only known specimen is now lost. The original locality is thought to have been somewhere on the slopes of the Nevado de Colima.

Senecio mexicanus McVaugh, sp. nov.

Herba perennis erecta foliosa 1–2.5-metralis, caule non fistuloso basi 1 cm diametro, e caudice breve lignoso gemmis brunneo-lanosis radicibusque fasciculatis carnosis, oriundo; caulis pars inferior foliaque pilis multicellularibus flaccidis rare

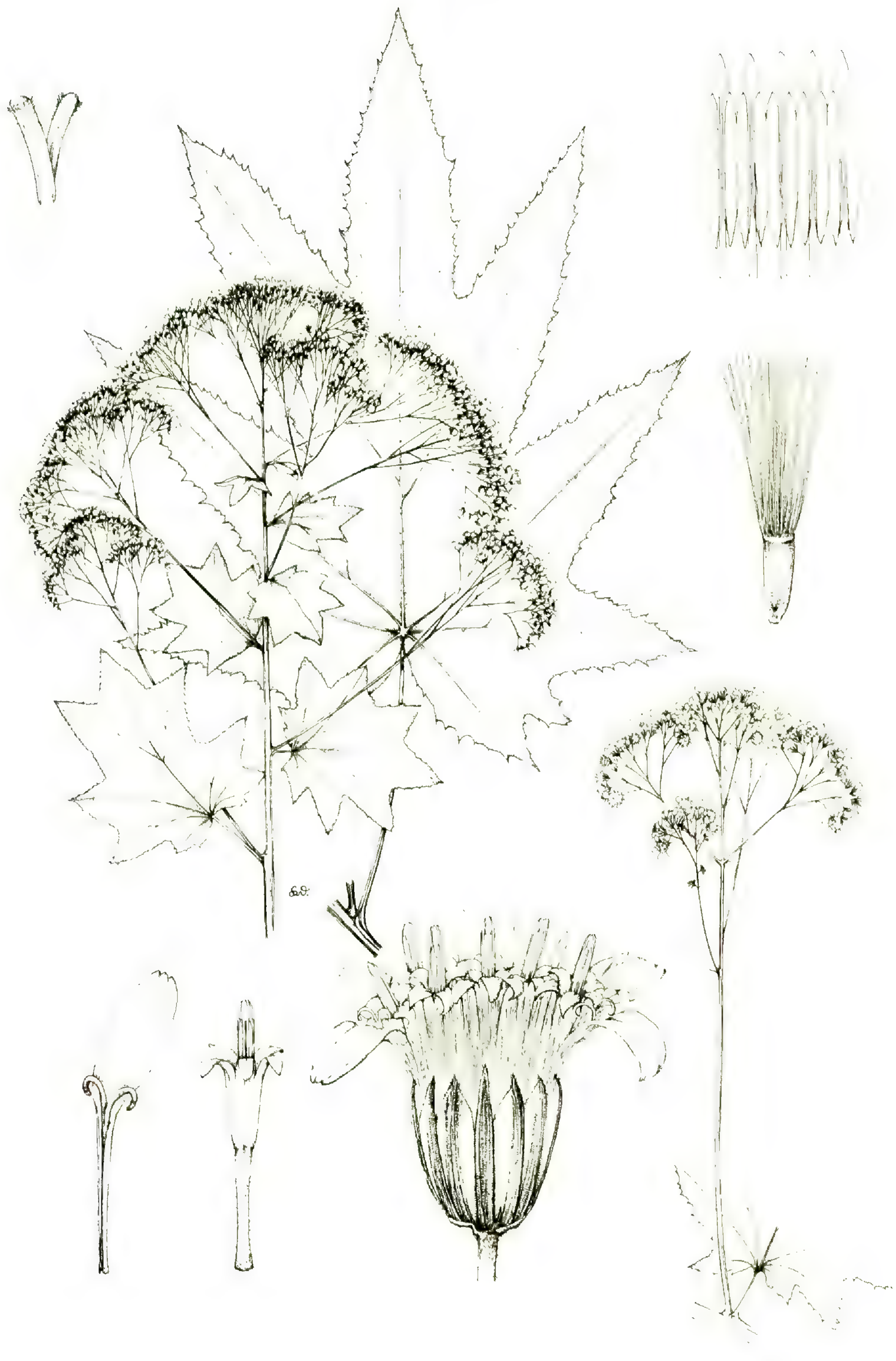

FIG. 55. *Senecio galicianus* (*McVaugh 22017,* type). Cauline leaf and diagram of inflorescence, X ¼; flowering branchlet, X ½; flowering head with some rays removed, corollas, and immature achene, X 5; anthers and style-tips, X 10.

pubescentia, et per pilorum bases persistentes paullo asperata, caulis pars superior inflorescentiaque glabra; folia ambitu suborbicularia, 10–20 cm longa lataque, palmatim 7–9-lobata, lobis majoribus plerumque 7–9 ovatis vel deltoideis 1.5–3 cm altis, interdum prope basin lobis minoribus instructa; lobi acuti vel obtusi, mucronati, marginibus loborum calloso-denticulatis, inter lobos saepe dentatis; laminae basi late sed non profunde cordatae; petioli foliorum majorum 6–20 cm longi; venatio palmata, venarum basalium paribus 3 vel ultra fere una abeuntibus, venulis supra reticulum subtile elevatum formantibus; inflorescentia terminalis ad 30–50 cm alta, composita, cymosa, corymbiformis, ramis inferioribus per folios caulinos deminutos breve petiolatos subtentis, ramulis minoribus per bracteas angustas glabras; capitula conferta, discoidea ca 1.5 cm longa, ad 50 vel ultra in quoque ramo versus apicem cymose aggregata, pedunculis bracteatis 3–10 (–20) mm longis; involucrum anguste campanulatum, bracteis accessoriis 5–8 appressis, rigidiusculis, obtusis, linearibus, 1–3 mm longis suffultum; phyllaria 8 subaequalia, apicibus minute pubescentibus exceptis glabra, 7–10 mm longa, exteriora linearia acuta 1–1.3 mm lata, interiora elliptica, obtusiora, 1.8–2.6 (–4) mm lata, tenuimarginata; flores disci (5–) 9–12 (–17), corollis glabris 9–10 mm longis aureis vel aurantiacis, tubo basi campanulato 4–5 mm longo, fauce saepe manifeste infundibuliformi, lobis lanceolatis recurvatis 1.7–3 mm longis; antherae 3.5–4.5 mm longae; styli ramuli 1.5–2 mm longi, apicibus ampliati, setosi; achaenia (immatura) plus quam 3 mm longa, ut videtur subfusiformia, longitudinaliter striata, apice in annulum pallidum ampliata, pilis pallidis brevibus inflatis obsita; pappi setae plurimae, capillares 6–8 mm longae; receptaculum alveolatum.

JALISCO: Tecalitlán, Sierra del Halo, pine forest, elev. 1700–2200 m, 28 Nov–1 Dec 1959, *McVaugh & Koelz 1170, 1262;* Huejotitán, Oct 1912, *Diguet* (P).

MICHOACAN: Hills of Pátzcuaro, 11 Nov 1890, *Pringle 3332* (MICH, type); 8 km N of Pátzcuaro, pasture in oak zone, elev. 1900 m, 25 Oct 1962, *McVaugh 21929;* 2 km SE of Carapan, grassland, elev. ca 1750 m, 22 Oct 1960, *Pippen 42.*

MEXICO: Temascaltepec, Nanchititla, oak forest, 26 Nov 1935, *Hinton 8745.*

GUERRERO: Mina, Yesceros to Cruz Pacífica, oak forest, 2550 m, 26 Nov 1939, *Hinton 14905;* Mpio. de Chichihualco, 10 km W of Camotla, pine-fir forest, elev. 2500 m, 30 Nov. 1963, *Rzedowski 18010;* 1 Dec 1963, *Feddema 2789.*

Although this plant was treated by E. S. Gibson (mss.) as a variety of *Senecio suffultus,* the two are so unlike that any close relationship between them seems improbable. They are reasonably similar in vegetative characters, and in having discoid rather than radiate heads, but *S. suffultus* is a very distinctive species having few large heads that are prominently leafy-bracted at base, and with more than 100 flowers in a head. *S. mexicanus,* on the other hand, suggests in appearance and in other characters something like *S. hartwegii* Benth., a species with radiate heads.

Senecio praecox (Cav.) DC., var. **morelensis** (Miranda) McVaugh, comb. nov. *Senecio morelensis* Miranda, Anal. Inst. Biol. [Méx.] 12: 603. 1941. *?Senecio velatus* Greenm. Ann. Missouri Bot. Gard. 1: 280. *pl. 13.* 1914.

Miranda commented upon the pubescence, and upon the differences between the leaves of *Senecio morelensis* and those of *S. praecox.* He described the leaves of *morelensis* as 8–9 cm long and 3–3.5 cm wide, but I have not seen any specimens with such narrow leaves. He gave the number of phyllaries in *morelensis* as 5–7, usually 7, but in all the specimens I have examined the number is consistently 8. The most striking difference between *praecox* and *morelensis* is in the number of disk-flowers (15–18, and 6–7, respectively). Perhaps this is enough to justify a specific segregation, but other morphological differences between the populations are not great. *Senecio velatus* seems to differ from *S. praecox* var. *morelensis* in having the leaves arachnoid-tomentulose. It seems to be known only from the type (*Pringle 5160!* from "bluffs of the barranca near Guadalajara"), and unless new localities for it are discovered, it may be treated as an extreme form of *S. praecox.*

FIG. 56. *Senecio mexicanus.* Upper part of flowering plant, detached cauline leaf, base of plant, × ½; flowering head, × 2.5; corolla, × 5; style-tips, × 10 (all from *McVaugh & Koelz 1170*). Achene, × 5 (*Pringle 3332,* type).

Senecio suffultus (Greenm.) McVaugh, comb. nov. *Cacalia suffulta* Greenm. Proc. Am. Acad. 32: 310. 1897.

Pippen (Contr. U.S. Nat. Herb. 34: 435. 1968) noted that this species did not belong in any of the "cacalioid" genera, and suggested that it be referred to *Senecio*. E. S. Gibson (mss.) has indicated the same opinion, but I cannot find that the combination under *Senecio* has ever been published.

Tribe VIII. Vernonieae

Vernonia alamanii DC., var. **dictyophlebia** (Gleason) McVaugh, comb. nov. *Vernonia dictyophlebia* Gleason, Bull, N.Y. Bot. Gard. 4: 203. 1906.

Both Gleason and Blake treated these taxa as distinct species, but they are not clearly separable by the characters employed by these authors. The var. *alamanii* (known chiefly from the mountains near Mexico City) has awns of the phyllaries mostly 2–4.5 mm long. In the var. *dictyophlebia*, which ranges from western Michoacán to Guerrero and the State of Mexico, the awns are usually 0.5–1.5 mm long and the leaves tend to be broader, more veiny and more pubescent. There are various intermediate forms.

Vernonia autumnalis McVaugh, sp. nov.

Herba perennis erecta 1–2-metralis, e caudice brevi radicibus fibrosis; caules florentes plerumque solitarii, basi ad 1 cm crassi vel crassiores, sulcati, purpureo-maculati, puberulentes (vetustiores glabrescentes), ramulis laxe pilis pallidis lucidis contortis obsitis et aliquantum resinoso-globuliferis; folia caulinia 10–15 plerumque obovata, 20–30 cm longa, 8–16 cm lata, interdum profunde lobata, lobis utroque latere 2–3, ovato-triangularibus, acutis; lamina supra pallida, rare arachnoideo-tomentosa et resinoso-globulifera, supra duriuscula scabridulaque, apice late acuta, e medio vel e loco supra medium ad basin longe attenuata, petiolo proprio 1–2 cm longo vel breviore; margines supra basin laminae angustam saltem dentibus utroque latere 20–30 denticulatae vel serratae; venae laterales utroque latere 8–15 divaricatae, subtus pallidae, prominentes; folia superiora minora, oblanceolata vel elliptica, subsessilia, basi apiceque rotundata vel acuta; corymbus pauciramosus quam planta tota ca 3-plo breviora, ramis ascendentibus ad 50 cm longis, nudis vel foliaceo-bracteatis, corymbis secondariis 6–15 cm latis, 3–10 cm altis terminatis; capitula 10–12 mm longa, 5–7-flora, umbellatim quoque fasciculo 15–25 aggregata, pedunculis 2–5 mm longis suffulta; involucrum ca 7–8 mm longum, anguste campanulatum, lavandulaceum vel purpureum; phyllaria ca 20–25, bracteis sub involucrum patentibus exclusis in seriebus 3–4 principalibus disposita; phyllaria interiora longiora 5–9, elliptica, acuta, 6.5–7.5 mm longa, apicem erosum versus strigosa, cum achaeniis deciduis; phyllaria mediana et exteriora multo breviora, elliptica vel ovata, anguste acuta vel mucronata, arachnoideo-pilosa vel -ciliata; flores rosei vel subrosei, corollis 7–8 mm longis, distaliter glanduloso-globuliferis, anguste tubuloso-infundibuliformibus, lobis acutis lanceolatis 2–3 mm longis; antherae 2 mm longae, basi obtuse auriculatae, appendicibus anguste acutis 0.6–0.8 mm longis; styli ramuli purpurei, hirsuti, corollae lobos sub-aequantes; pappus albus, setis grossis rigidis barbellatis ca 30, 5–6 mm longis, squamellis exterioribus anguste linearibus planis 1–1.5 mm longis; achaenia albo-flavida 3–3.5 mm longa, molliter appresse-pilosa et pappi basi praecipue glanduloso-globulifera, anguste obovoidea, obscure 3-angulata costulis validis 5–7, vel compressa costulis ventralibus (1), lateralibus (2), dorsalibusque (3); receptaculum foveolatum, achaeniorum cicatricibus substipitatis.

FIG. 57. *Vernonia autumnalis* (*McVaugh 19833*, type). Upper part of plant and lower cauline leaf, X ½; flowering head, X 2.5; corolla, X 5; anthers and style-tips, X 10. The achene (X 7.5) is from *McVaugh 21171*.

JALISCO: Mountainsides above La Cuesta, road to Talpa de Allende, humid forests of oak and other deciduous trees, elev. 800–1000 m, 15–16 Oct 1960, *McVaugh 20268;* 19 Nov 1960, *McVaugh 21171;* Mpio. de Cabo Corrientes, 5 km N of El Tuito, oak forest in stream valley, elev. 650 m, 16 Dec 1970, *McVaugh 25468, 25476;* 5 km S of La Huerta, in oak forest, elev. 500–550 m, 3 Oct 1960, *McVaugh 19833* (MICH, type).

The 5–7-flowered heads and the deciduous inner phyllaries of this species indicate some relationship with what Gleason treated as a distinct genus, *Eremosis* (N. Am. Flora 33: 95–101. 1922). By most recent authors these species have been included in *Vernonia.* As far as I can learn, all the other North American species are shrubby.

Vernonia bealliae McVaugh, nom. nov. *Vernonia corymbiformis* sensu Gleason, Bull. N.Y. Bot. Gard. 4: 198. 1906, not *V. corymbiformis* DC. 1836.

JALISCO: San Sebastián, *Nelson 4098* (GH, type; US), *Mexia 1637* (US), *1766* (MICH, US), *Anderson & Anderson 5958;* Talpa de Allende, *McVaugh 23430;* Autlán, *McVaugh 10331;* Tecalitlán, *McVaugh & Koelz 1165.*

MICHOACAN: Coalcomán, *Hinton 13674* (US), *McVaugh 22730.*

Although Gleason used the name *Vernonia corymbiformis* DC. for this species, he said "that this identification is correct is by no means certain." In fact DeCandolle's specimen (*Karvinski! s.n.,* in G–DC), from some unknown locality in Mexico, apparently represents a species not found in Nueva Galicia. The leaves are pubescent beneath, the inflorescence and peduncles pubescent, the involucre nearly glabrous, 9 mm high, the phyllaries about 40, the outer ones tapering then with terminal cusp 0.3–0.4 mm long; the inner phyllaries are membranous, lanceolate, 1.5 mm wide, acute, scarcely cuspidate. This agrees well with the original description (in DC. Prodr. 5: 62. 1836).

In *V. bealliae* the phyllaries are about 50, all subulate-tipped and often notched at the base of the awn. *V. bealliae* is a plant of steep barrancas and humid forested mountainsides with *Abies, Pinus, Quercus* and other broad-leaved trees, at elevations from 1600 to 2600 m, flowering December to April. Apparently it is unknown except from Nueva Galicia.

Vernonia cordata H.B.K. Nov. Gen. & Sp. 4: 39. 1820. *Vernonia morelana* Gleason, Bull. Torrey Bot. Club 46: 241. 1919.

Gleason, in his work on the North American Vernonieae, seems not to have noted the name *Vernonia cordata.* The type, which I studied in Paris in May 1970, has cordate, petiolate leaves tomentose beneath; the flowers are about 10 in a head and the achenes glandular. Kunth, in the protologue, made special note of this last feature, which Gleason also emphasized as characteristic of *V. morelana.*

The var. *cordata* is found in the State of Mexico, in Morelos (*Pringle 7697!*, the type of *V. morelana*), and in Guerrero (Taxco, *Humboldt & Bonpland!,* the type). In this population the plants are a little more densely pubescent than those in Nueva Galicia, the petioles of the branch-leaves are 7–12 mm long (as against 3–5 mm), and the achenes are copiously dotted with large pale resinous globules. The heads of *V. morelana* were described by Gleason as 21-flowered, but in most specimens of both varieties there are 10–12 flowers in a head.

Vernonia cordata H.B.K., var. **hooveri** McVaugh, var. nov.

Frutex arborescens 3–6-metralis, tomentosus, foliis caulinibus elliptico-ovatis 20–30 cm longis, ramorum florentium 5–10 cm longis, petiolis 3–5 mm longis; capitula plurima, subumbellatim fasciculata, cymis obscure scorpioideis, ramis non manifeste racemosis sed prope apices capitula 1–4 sessilia ferentibus, vel capitulis paucis pedunculatis; capitula 9–12-flora; phyllaria arachnoideo-ciliata ca 25, interiora (achaenia subtendentia) 8–9; corolla 6 mm longa; achaenia clavato-columnaria, immatura 2.5–2.8 mm longa, strigosa sed vix vel haud glandulosa.

Varietas amici olim in terram mexicanum comiti David Beall Hoover, qui mecum anno 1951 plantas ejusdem varietatem collectavit, nominavi.

JALISCO: 10–11 km NE of Talpa de Allende, in oak-pine forest, elev. 1500 m, 1 May 1951, *McVaugh 12217* (MICH, type); Nevado de Colima, SE foothills in oak-pine forest, elev. ca 1600 m, 5 Apr 1951, *McVaugh 11802;* 16 km NE of Tecolotlán, dry oak forests near summits, elev. ca 1680 m, 10 Apr 1951, *McVaugh 11964;* S of Jilotlán de los Dolores, deciduous forest, elev. 800 m, 9–10 Mar 1965, *McVaugh 22912.*

MICHOACAN: 7–15 km from Ario de Rosales, road to Gabriel Zamora, oak forest, elev. 1100–1350 m, 22 Feb 1970, *Anderson & Anderson 5835.*

GUERRERO: Dist. Montes de Oca, San Antonio, 14 Apr 1938, *Hinton 14009;* Mpio de Tlacotepec, Aserradero de Yerba Santa, pine-oak forest, 2000 m, 12 Apr 1963, *Rzedowski 16533.*

Vernonia feddemae McVaugh, sp. nov.

Herba perennis valida erecta plus quam 1-metralis, caule striato 5–7 mm crasso, inferne glabrescenti, superne pubescenti, ramulis phyllariisque copiose pilis lucidis basi rigidis sed contortis, implexis, obsitis; phyllaria etiam arachnoideo-ciliata; folia coriacea, supra laevia glabraque, subtus sparsim arachnoideo-tomentosa; globulae resinosae pallidae in foliorum superficiebus inferioribus (abaxialibus), ramulis, phyllariis, corollae lobisque abundantes; folia pennivenia ovata vel oblonga vel elliptica, 8–12 cm longa, 3–5 cm lata, acuta vel obtusa, basi rotundata, marginibus obscure denticulatis, revolutis plerumque ut videtur integris, basi breviter cuneatim in extensionem petioliformen 2–5 mm longam productis, petiolo ipso nullo vel ad 5–6 mm longo; corymbus terminalis myriocephalus ca 35 cm altus latusque, ramis principalibus valde ascendentibus 5–6, 3–4-plo diffuse furcatis, prope medium foliato-bracteatis, in corymbis secondariis terminantibus; capitula erecta, angusta, ca 1 cm longa, 3–5-flora, ramulis gracilibus pedunculiformibus 1–1.5 cm longis suffulta, quoque ramulo bracteis 6–15 ovatis vel orbiculatis vel obovatis 1–2 mm longis, cucullatis, pubescentibus instructo; involucrum ca 6 mm longum, 3–4-seriatum, phyllariis exterioribus gradatim brevioribus, extimis in pedunculi bracteas sensim transientibus; phyllaria 20–25, apicibus et nervo medio valido subcarinato purpurascentia, interiora longiora 3 (–5), elliptica vel oblanceolata, 5–6 mm longa, 1.3 mm lata, acuta vel breve acuminata mucronataque, facile separata sed cum floribus non statim cadentia, marginibus tenuibus glabris; phyllaria mediana exterioraque plerumque ovata, apicibus mucronatis, fere latitudine tota pubescentia; flores purpurei; corolla infundibuliformis 8–9 mm longa; antherae 2 mm longae, basi auriculatae, appendicibus acutis lanceolatis 0.6–0.8 mm longis; pappus 4.5 mm longus, setis ca 30 albis grossis barbellatis, squamellis exterioribus lineari-subulatis 0.7–1.3 mm longis; achaenia recta 2.5 mm longa, distaliter ampliata, dorso-ventraliter compressa, ca 8-costulata, pilis longis, sericeis pallidis dense obsita, sed ut videtur non glandulosa; receptaculum fere planum, achaeniorum cicatricibus rotundatis.

NAYARIT: Pastures and clearings ca 5 km NE of Puga (ca 15 km NE of Tepic), elev. ca 1000 m, 22 Aug 1959, *Feddema 846A* (MICH, type).

In habit this suggests the species related to *Vernonia serratuloides* H.B.K., *V. capreaefolia* (Sch. Bip.) Gleason, and *V. sinclairii Benth.*, but all those have 8 or more flowers in a head. The repeated forking of the branches of the corymb, and long peduncle-like but multibracteate branchlets that support the heads, appear to be unique among Mexican Vernonias.

Vernonia koelzii McVaugh, sp. nov.

Frutex 2.5-metralis ramis longis arcuatis, caulibus minute glandulari-papillosis, ramis etiam paullo pubescentibus; rami hornotini petiolique canescentes; phyllaria dorso marginibusque arachnoideo-pilosa; folia supra maturitate glabra vel subglabra, bullata (venulis paullo impressis), epidermidis cellulis convexis refractivisque; pagina folii inferior resinoso-globulifera, pilis 1 mm longis vel brevioribus grosse sed rare pilosa; folia penninervia ovata 10–21 cm longa, 4–7.5 cm lata, 2–3-plo longiora quam

latiora, ad apicem acutum vel acuminatum sensim angustata, basi rotundata, marginibus obscure calloso-denticulatis, petiolis 5–10 mm longis; rami foliacei florentes saepe 0.5–1 m longi, ramulis paucis (2–5) ascendentibus 15–30 cm longis, capitulis in ramulis spurie racemosis sessilibus, solitariis vel binis in nodis 1–2.5 cm distantibus, nodis per bracteas foliaceas lanceolatas 2–6 cm longas subtentis; capitula 1 cm longa, 24–25 (–30?)-flora; involucrum 7–8 mm longum, cyathiforme, basi rotundatum, 4–6-seriatum, phyllariis exterioribus multo brevioribus; phyllaria rigida 50–60,

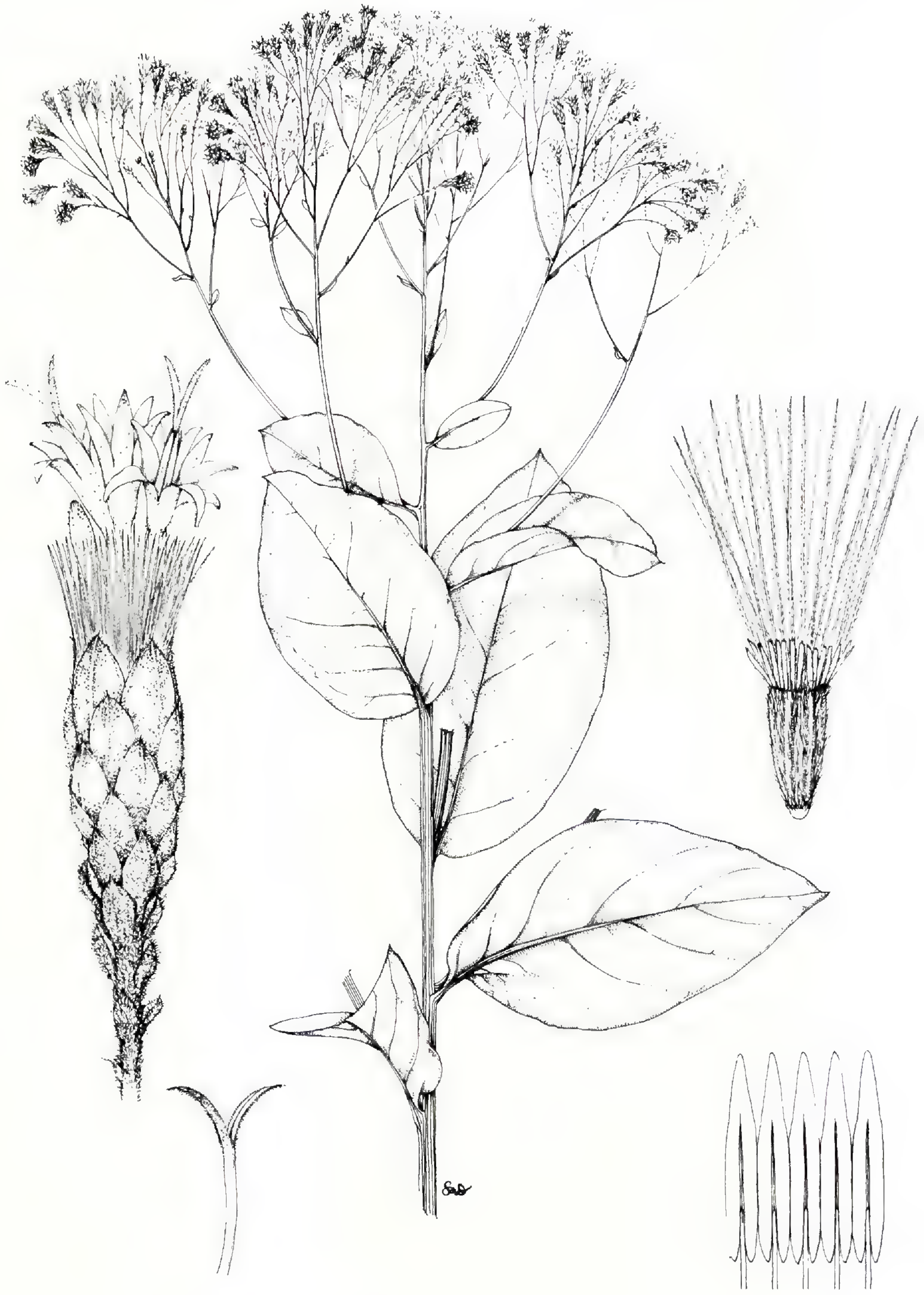

FIG. 58. *Vernonia feddemae (Feddema 846A,* type). Upper part of plant, X ½; flowering head, X 5; achene, X 7.5; style-tips and anthers, X 10.

purpurascentia, interiora longiora 15–19 (–21?), achaenia subtendentia, lanceolata, 1.5–2 mm lata, apicibus tenuibus, acutis brevissime mucronatis; phyllaria mediana exterioraque ovata vel lanceolata, apicibus attenuatis spinulosis, extima laxe subpatentia; flores purpurei; corolla pro capituli magnitudine brevis, 7 mm longa, anguste infundibuliformis, lobis angustis acutis 2 mm longis, prope apices resinoso-globuliferis; antherae flavidae 2–2.3 mm longae, longe exsertae, basi auriculatae, appendicibus 0.5–0.8 mm longis; styli ramuli ca 2 mm longi hispidi attenuati; pappus setis albis ca 25, rigidis barbellatis 6 mm longis, squamellis exterioribus planis lineari-subulatis 1–1.8 mm longis; achaenia (immatura) 2.5 (–3?) mm longa, clavato-columnaria, truncata, dense pilis albis appressis obsita, prope basin glanduloso-globulifera, costulis ca 10 convexis instructa; receptaculum ca 2 mm latum, glabrum, reticulatum.

COLIMA: Mountain summits near the pass ca 17–18 km SSW of Colima, in area of gypsum and slate, in deciduous forest of *Bursera, Amphipterygium, Cyrtocarpa, Cephalocereus,* elev. 400–500 m, 7–8 Dec 1959, *McVaugh & Koelz 1576* (MICH, type). Otherwise unknown.

This is apparently one of a small group of North American species having large sessile heads in elongate leafy-bracted cymes, pubescent achenes, acute phyllaries and broad ovate leaves. The inflorescence and the involucre in *V. koelzii* resemble those of *V. argyropappa* Buek, but that is usually herbaceous, with narrower and evidently sericeous-pilose leaves, and subulate phyllaries.

Vernonia michoacana McVaugh, sp. nov.

Frutex procerus arborescens 3–4-metralis, puberulens, resinoso-globuliferus, interdum pilis brevibus erectis rigidis instructus; inflorescentia foliaque utrinque pubescentia, vel folia demum venis majoribus exceptis glabra; phyllaria extima tomentulosa; folia elliptico-lanceolata, 8–12 cm longa, 2–3.5 cm lata, 3–3.5-plo longiora quam latiora, penninervia, subtus crebre resinoso-globulifera, apice acuta vel obtusa, basi acuta vel paullo rotundata, marginibus revolutis, remote denticulatis vel omnino integris, basi breviter cuneatim decurrentibus, petiolis fere nullis vel 2–4 mm longis; inflorescentia paniculiformis rotundata vel paullo elongata 20–30 cm longa, 20–25 cm lata, ramis divaricatis foliato-bracteatis 8–12 cm longis, quoque ramo fasciculum confertum capitulorum 50–100 parvorum pallidorum ferenti, pedunculis 1–1.5 mm longis vel brevioribus; capitula 1-flora, 9–10 mm longa, involucrum cylindro-campanulatum 4.5–5.5 mm longum, multo longius quam latius, phyllariis 3–4-seriatis, exterioribus longitudine valde decrescentibus; phyllaria ca 15, albo-viridia vel exteriora saltem apicibus brunnescentibus, ciliata, exterioribus exceptis glabra, prope apicem resinoso-globulifera; phyllaria interiora longiora 4–5.5 mm longa; anguste elliptico-lanceolata, 0.7–0.9 mm lata, obtusa vel subacuta, intima 3 multo longiora, facile separata et sub anthesi etiam cadentia; phyllaria mediana exterioraque late elliptica vel late ovata, plerumque obtusa; flores albi vel pallide subrosei; corolla sparsim resinoso-globulifera 6–7 mm longa, tubo subcylindrico 2.5–3 mm longo, 0.3 mm crasso, in faucem dilatatam transienti, lobis angustis acutis 2.5 mm longis; antherae 1.7 mm longae, basi auriculatae, bene exsertae, appendicibus acutis 0.7 mm longis; styli ramuli 1.5 mm longi; pappi setae principales albae ca 35, barbellatae 4.5 mm longae, exteriores setiformes 0.5–1.5 mm longae; achaenia clavato-columnaria immatura 2 mm longa, teretia, obscure costulata, pilis sericeis pallidis appressis dense obsita; receptaculum glabrum, achaenii cicatrice elevata.

MICHOACAN: Ca 8 km NW of Aguililla, road to Aserradero Dos Aguas, thickets in oak zone, elev. 1200 m, 2 Mar 1965, *McVaugh 22668* (MICH, type); ca 20 km S of Arteaga, in oak forest, elev. 825 m, 25 Feb 1965, *McVaugh 22556.* Otherwise unknown.

In the basin of the Río Tepalcatepec and the dry mountains in nearby Michoacán this seems to be the only representative of the species-complex that includes *Vernonia salicifolia* (DC.) Sch. Bip and the very similar *V. pallens* Sch. Bip. In Nueva Galicia *V. salicifolia* is a plant of rocky woods and summits above 2000 m, mostly on the Central

FIG. 59. *Vernonia koelzii* and *V. michoacana*. *V. koelzii* (lower figures, all from *McVaugh & Koelz 1576,* type): Flowering branch, X ½; flowering head, X 4; corolla, X 5; achene, and style-tips, X 7.5; anthers, X 10. *V. michoacana* (upper row of figures, all from *McVaugh 22668,* type): Flowering branchlet, X ½; flowering head, and corolla, X 5; achene, and style-tips, X 7.5; anthers, X 10.

Plateau. The heads are invariably purplish, larger than those of *V. michoacana,* with corollas 11–13 mm long. *V. pallens* is a somewhat doubtful species, treated by both Gleason and Blake as synonymous with *V. leiophylla* (Gleason) Blake. In the type of *V. leiophylla (Pringle 6188!),* from above Cuernavaca, Morelos, the involucres are pale (not purplish), the leaves tend to be tufted in the vein-axils beneath (as in *V. salicifolia* but not in *V. michoacana*), the corollas are about 9 mm long, and the inner phyllaries are about 1.5 mm wide, narrowly acute or even mucronate. Pending a thorough revision of the entire complex, *V. michoacana* is maintained as distinct from the other taxa involved.

Vernonia salicifolia (DC.) Sch. Bip., var. **baadii** McVaugh, var. nov.

Frutex procerus vel arborescens 2–4 m altus, fere glaber; folia subtus in venarum majorum axillis plerumque barbata, pennivenia, 8–20 cm longa, (2.5–) 4–7 cm lata, 2.3–3 (–3.7)-plo longiora quam latiora, petiolis 8–15 mm longis; involucrum 4.5–5.5 mm longum, purpureum; phyllaria acuta 15–20, interiora 1.5 mm lata; corolla 8.5 mm longa; antherae 2.3 mm longae. A varietatibus ceteris folia latiora, petiolis longioribus, floribus minoribus, differt.

Varietas in honorem dixi Michael Francis Baad (1941–), botanici nunc californici, qui mecum anno 1965 plantas mexicanas plurimas collectavit.

JALISCO: San Sebastían, Arroyo del Triangulo, elev. 1425 m, 20 Mar 1927, *Mexia 1904;* Talpa de Allende, headwaters of a west branch of Río de Talpa, pine forest, elev. 1200–1450 m, 28–30 Mar 1965, *McVaugh 23329;* 20 km SE of Talpa, 8–10 km S of El Rincón, mountain stream valley, elev. 1600 m, 2–3 Apr 1965, *McVaugh 23473* (MICH, type).

MICHOACAN: Coalcomán, elev. 1000 m, 14 Mar 1939, *Hinton 13651.*

Mrs. Mexia's collection was originally named *Vernonia pallens,* and Hinton's collection *V. salicifolia.* As explained above under *V. michoacana,* the taxonomy of this whole species-complex remains to be worked out. What is described here as var. *baadii* is a broad-leaved, long-petioled extreme that seems to be localized in relatively humid situations in the mountains of the Pacific slope of Jalisco and Michoacán, where no other representative of *V. salicifolia* is known.

Vernonia steetzii Sch. Bip., var. **aristifera** (Blake) McVaugh, comb. nov. *Vernonia aristifera* Blake, Contr. U.S. Nat. Herb. 23: 1415. 1926.

There is much variation in the extent to which the phyllaries are mucronate in this species, and it does not seem possible to separate *V. steetzii* from *V. mucronata* Blake [=*V. foliosa* (Benth.) Sch. Bip.] on the basis of this one feature, as was done by Gleason and Blake. *V. aristifera* belongs to the same complex; in its extreme form it seems quite different from *V. steetzii* because of its prevailingly ovate and tomentose leaves, very slightly larger heads, and longer mucros on the phyllaries. In northeastern Jalisco and nearby Aguascalientes and San Luis Potosí, however, many plants are intermediate in pubescence, in leaf-shape and in the length of the mucros, between typical *V. steetzii* as it occurs a little farther west and northwest, and *V. aristifera* which is mainly a plant of somewhat lower elevations in central Jalisco.

NORTH AMERICAN COUNTERPARTS OF *SIGESBECKIA*[1] *ORIENTALIS* (COMPOSITAE)

by

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[1]Spelled *Siegesbeckia* by almost all authors. Linnaeus consistently used the spelling *Sigesbeckia*, although he had originally named the genus in honor of J. G. Siegesbeck. The shorter spelling evidently is the correct one.

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Bentham (Benth. & Hook. Gen. Pl. 2, pt. 1: 359. 1873) regarded *Siegesbeckia* [sic] as a genus of two species, one (*S. orientalis* L.) widely distributed in the tropics and subtropics of both Old and New Worlds, the other (*S. flosculosa* L'Her.) a native of Peru. According to this concept, *S. orientalis* included not only all the populations from the Old World, but also several New World populations that had been proposed as independent species by other authors. Since Bentham's time the proper disposition of these American plants has been a matter of question. North American specimens have generally been referred to *S. orientalis* or to *S. jorullensis* HBK., South American specimens to *S. orientalis, S. cordifolius* HBK., or *S. agrestis* Poepp. & Endl.

After study of many herbarium specimens from North America, and a selection of the available material from South America and from the Old World, we conclude 1) that *S. orientalis* L., sensu lato, is restricted to the Old World as a native plant, although introduced at a few localities in the American tropics; 2) that regional populations of *S. orientalis* exist and are readily recognizable by gross morphological features; 3) that most of the New World Sigesbeckias that have been called *S. orientalis* (both North and South American) represent a single species (*S. jorullensis* HBK.), this mostly in humid mountain ranges at elevations above 2500 m, from western Mexico to Chile; and 4) a second species (*S. agrestis* Poepp. & Endl.), previously confused with *S. jorullensis,* ranges from western Mexico to Amazonian Peru, occupying a somewhat drier, warmer habitat than that of *S. jorullensis,* mostly at elevations less than 2000 m.

We have examined most of the specimens from the herbarium of the Field Museum (F), the Harvard University herbarium (GH), the New York Botanical Garden (NY), the University of Michigan (MICH), the University of Texas (TEX), and the United States National Herbarium (US), and we wish to express our thanks to those in charge of these herbaria. We were able to study the type of *S. agrestis,* and selected other specimens from the Naturhistorisches Museum, Vienna (W), through the kindness of Prof. K. H. Rechinger. Dr. Alicia Lourteig, of the Muséum National d'Histoire Naturelle, Paris (P), very helpfully verified our tentative conclusions as to the identities of the types of *S. jorullensis* and *S. cordifolia.* Publication of this contribution was supported by the National Science Foundation (Grant GB-5218X, to McVaugh).

In the American tropics there are several small helianthoid genera, including *Sigesbeckia,* that are alike in a number of distinctive features, enough to suggest that they may be closely related. They are normally opposite-leaved, with a tendency to the production of stipitate glands at least in the inflorescence; the achenes are epappose; the achenes of the ray florets are equal in number to, and closely subtended by, the thin inner phyllaries; there is an outer series of phyllaries, usually 5 in number, that are more or less foliaceous and often spreading, morphologically unlike the inner series. The species of *Sigesbeckia* discussed below, for example, are so similar to Mexican species of *Trigonospermum* that the two are often confused; the two genera are distinguished on the basis of the disk flowers, which are fertile in *Sigesbeckia,* sterile in *Trigonospermum. Rumfordia* seems to differ from *Sigesbeckia* chiefly in having larger heads and broader phyllaries, and *Polymnia* differs from *Trigonospermum* in much the same way. It may be premature to speculate further upon this, but it does seem that Bentham's disposition of these four genera on the basis of a single character may have been too artificial; in his system *Trigonospermum* and *Polymnia* (with disk flowers sterile) were assigned to subtribe Melampodieae, whereas *Rumfordia* and *Sigesbeckia* were placed in subtribe Verbesineae.

The following key provides a contrast between *Sigesbeckia orientalis, sens. lat.,* and the North American species that have been confused with it. The latter are both

tall, much-branched annuals or short-lived perennials with very narrow outer phyllaries. The other known American species include *S. flosculosa* L'Her., a South American species unique in having very short rays and triandrous disk-flowers; and two short-stemmed or subacaulescent perennial North American species with fewer, larger heads and relatively broader phyllaries, viz. *S. repens* Rob. & Greenm., and *S. nudicaulis* Standl. & Steyerm.

1. Petioles long-tapering to the base, not prominently amplexicaul nor auriculate-winged at base; leaves resinous-dotted beneath, coarsely toothed, the blades often sub-hastately toothed or sub-lobulate, the lower teeth often much enlarged; outer phyllaries copiously pilose on the outer (abaxial) surface with eglandular hairs, coarsely stipitate-glandular on the inner surface (the glandular hairs very stout, 0.5 mm long); achenes 3–3.5 mm long. *S. orientalis.*

1. Petioles broadly winged or, if long-tapering to the base, finally expanded and auriculate or subamplexicaul; leaves serrate or serrulate, the lower teeth rarely much larger than the upper ones; outer phyllaries glabrous on the abaxial surface or with a few stipitate glands, if with a few eglandular hairs then finely stipitate-glandular (the glandular hairs hardly more than 0.1–0.3 mm long); achenes 1.8–2.5 mm long.
   2. Leaves without resinous dots beneath; anthers green; narrow outer phyllaries without long simple hairs, but with stipitate glands about 0.5 mm long; receptacle (after the achenes fall) broader than long, less than 1 mm long. *S. jorullensis.*
   2. Leaves with many resinous dots beneath; anthers yellow; narrow outer phyllaries usually with a few eglandular hairs, and many stipitate glands 0.2–0.3 mm long; receptacle longer than broad, 1–2 mm long. *S. agrestis.*

1. **Sigesbeckia orientalis** L. Sp. Pl. 900. 1753.

Type locality: "Habitat in China, Media *ad pagos.*" Type: The account in the *Species Plantarum* was derived partly from Buxbaum and Plukenet, and partly from the *Hortus Cliffortianus* and the *Hortus Upsaliensis.* As Linnaeus knew the plant from Clifford's garden and from his own garden in Uppsala, the name of the species may be typified by one of his own specimens. The specimen in the Linnaean Herbarium in London (no. 1018–1) labelled "orientalis" in the hand of Linnaeus, may well stand as the type. It is readily identifiable from a photograph, by leaf-characters, as a member of the Old World assemblage that has always been called *Sigesbeckia orientalis.*

The distinctions between Old World and New World material are mostly in matters of degree. The most easily recognized differences are set forth in the key above. Others are as follows: Specimens of *S. orientalis* are in general more uniformly gray-pubescent, the leaves with short appressed hairs, the branchlets and peduncles with soft spreading hairs; the phyllaries are very coarsely stipitate-glandular, the stipes often rigid, curved, and much enlarged at base; the inner phyllaries are usually relatively strongly incurved and infolded, obtuse, 3–5 mm long (as against 2–3 mm long in American material), with many large rigid glands on the backs; achenes often pebbled, with irregular transverse markings in addition to the longitudinal striae; summit of mature achene usually with a definite low collar left at the fall of the corolla (the corresponding scar in American material flat or with barely perceptible ring-like thickening).

To summarize, *S. orientalis* L., sens. lat., consistently differs from the American species with which it has been confused, in having slender petioles not foliaceous at the base, more coarsely and often hastately toothed leaves; more abundant short hairs on the leaves and soft spreading hairs in the inflorescence; larger and more rigid and curved glandular hairs; larger phyllaries, pales, and achenes; more obtuse, rigid and strongly curved and glandular inner phyllaries; more noticeable surface markings on the achenes and more prominent corolla-scars. None of these differences in itself seems very important taxonomically, but in sum they make it clear that the assemblage of populations in the Old World is not to be confused with that in the New World. As taxa are ordinarily delimited in the Compositae, these extremes cannot logically be combined into a single species.

To take up the question of the taxonomy of *Sigesbeckia orientalis* is beyond the scope of this paper. Examination of a relatively small number of specimens suggests that several or many regional intra-specific races can be recognized. Several supposed species occurring in eastern Asia have been segregated in recent years from the inclusive *S. orientalis.*

Although the species was described as a native of Mexico, the name *Siegesbeckia triangularis* Cav. (Ic. 3: 27. *pl. 253.* 1795) is evidently a synonym of *S. orientalis* and does not apply to an American plant. Cavanilles clearly described and figured the Old World plant; in his description he went so far as to characterize the coarsely and unevenly serrate leaves as "lobed." His specimens were cultivated in the Madrid garden, supposedly from Mexican seed. From about 1790 onward, however, Cavanilles was receiving not only Mexican seeds from the Royal Botanical Expedition to New Spain, but also many samples of seeds from Née and others who had visited the Old World tropics. It is likely that in this instance, as in some others, there was some error involved.

Apparently *Sigesbeckia orientalis* has been introduced to a very limited extent into the United States, and sparingly into tropical America. We have seen the following specimens:

UNITED STATES: ILLINOIS: Menard Co., Athens, *Lansing & Sherff 41* (F).
"MEXICO": Ex hort. Matrit. (F, probably fragment of type of *S. triangularis*).
PERU: Without locality, ex herb. Sullivant (NY).
BRAZIL: Near Rio de Janeiro, weedy, *Dusén 72* (F), *230* (NY), *Pereira 4894* (F). Santa Catarina, *Smith & Reitz 12279* (NY).

2. **Sigesbeckia** [*Siegesbeckia*] **agrestis** Poepp. & Endl. Nov. Gen. & Sp. Pl. 3: 45. *pl. 256.* 1843.

In forest or on forest-edges, on shaded banks, along trails and streams, sometimes weedy, in cornfields and clearings, western Mexico to Amazonian Peru. On the Pacific slope of Mexico it is fairly common at elevations of from 1000 to 2000 m (up to about 2500 m), mostly in oak-, oak-pine, or sometimes in pine-fir forest, flowering from September to January. It ranges considerably farther west than *S. jorullensis,* which occurs chiefly in more humid forests at higher elevations. In Central and South America *S. agrestis* seems to occupy approximately the same ecological niche as it does in Mexico, except that the associated species may be quite different. Judging from the small number of collections that have been made, *S. agrestis* is comparatively far less abundant in South America than *S. jorullensis.*

Our concept of *S. agrestis* is based on the plate published by Poeppig and Endlicher, Poeppig's No. 1772B at Vienna, and a photograph (Field Mus. neg. 15186) of Poeppig's No. 1771B at Berlin. All these seem unquestionably to represent the same species. No number was cited in the protologue, and the situation is otherwise confused. In the protologue the date of collection is given as February, and the locality as "in cultis Peruviae circum Cuchero." The Vienna specimen that we take to be the type is labelled not "agrestis" but "arvensis," and the pertinent data are "Peruvia subandina pr cultis ad Pampagaio Febr. 1830." Evidently in the course of publication the epithet was changed, and the precise locality of collection suppressed in favor of a more generalized statement. In spite of these discrepancies we see no reason to question the typification of *S. agrestis.*

Another name based on a collection by Poeppig (*Siegesbeckia serrata* DC. in DC. Prodr. 5: 496. 1836) appears to represent one of the populations of the *jorullensis-cordifolia* group. We have not seen the type (*Poeppig diar. 463, herb. n. 55,* in herb. DC.), but a photograph (Internat. Doc. Cent. microfiche, Prodromus herbarium No. 923) of the specimen suggests that it belongs with *jorullensis* rather than with *agrestis.*

Erect, single-stemmed annual up to 1–2 m high, often much smaller, the stem up to 6–7 mm in diameter at base, repeatedly forked above the middle with a terminal

nodding long-pedunculate head in each fork, the lateral branches (except near tips of the inflorescence) much surpassing the terminal heads; herbage pilose-hirsute with hyaline multicellular taper-pointed collapsing hairs, these often very many on the middle and lower stem, where up to 3–5 mm long, and on the lower leaf-surface where 2–2.5 mm long; upper leaf-surface with fewer more rigid hairs; upper stems, peduncles, bracts and phyllaries finely stipitate-glandular, the glandular hairs 0.2–0.3 mm long; leaves resinous-dotted beneath; upper cauline leaves narrowest, usually lanceolate, sessile with broad auriculate bases, the lower leaves with ovate blade prolonged into broadly margined, broadly auriculate clasping petiole; blades of the principal leaves 5–12 cm long, 3–8 cm wide, triplinerved, coarsely or very shallowly and sinuately serrate, acuminate, rounded at base and merging gradually into the petiolar base, the latter 0.6–1.0 (–4) cm wide, 1.5–4 cm long; blades occasionally broadly ovate and truncate or subcordate at base; bracteal leaves lanceolate, sessile, those of the upper forks successively smaller; heads small and inconspicuous, about 5 mm high and 7 mm wide, forming a loose panicle, solitary in the forks and at the tips, thus 125 or fewer in a plant forking 6 times; peduncles 5–20 mm long or the central ones 3–4 cm long, all hooked at the apex in age; outer phyllaries 5, often reflexed at maturity, linear-oblanceolate or spatulate, 3–10 mm long, 1–1.5 mm wide or less, stipitate-glandular on the margins and the adaxial surface and often with long non-glandular hairs as well; inner phyllaries 8 (–13), green or purplish, elliptic-obovate, 2.5–3 mm long, obtusely keeled, each subtending and appressed to a ray-achene, acute, ciliate, glandular on the back; pales obovate, membranous, scarious, like the inner phyllaries but thinner, more obtuse, scarcely glandular, the innermost narrower; ray-florets 5–8 (–13), the tube 0.6–1 mm long with both glandular and eglandular hairs; ligule 2.5–3 mm long, yellow, glandular-dotted, the lobes 0.7–1.1 mm long; disk florets (5–) 8–13 (–34), the tube 0.5–1 mm long, with both glandular and eglandular hairs; throat campanulate, 0.6–1 mm long, glandular-punctate, the lobes 0.5 mm long; anthers yellow, 0.8 mm long, the narrowly triangular appendages 0.3 mm long; style branches 0.5 mm long; achenes nearly black, 1.5–2 mm long, 4-angled and nearly square in cross-section, 0.6–1 mm wide at the truncate apex, with flat circular scar; sides tapering to the narrow substipitate base, slightly convex, lineate and often noticeably ribbed; receptacle conic, about 1 mm high, the central pales often persistent on it.

In exceptionally vigorous forms the outer phyllaries may become foliaceous, up to 9–11 mm long and 2 mm wide. Flower color, if not noted merely as "yellow" is often recorded by collectors as "deep yellow," "golden," "orange-yellow," or "orange."

MEXICO: SINALOA: Sierra Madre, El Batel, 4000 ft, *Mexia 469* (US); 6 mi west of El Palmito, 6000 ft, *D. Flyr 317* (TEX). JALISCO: San Sebastián to Mascota, *Mexia 1410 p.p.* (MICH, mixed with *Jaegeria hirta*); Talpa de Allende, *McVaugh 20135* (MICH); Sierra de la Campana, *McVaugh 20065* (MICH); 28 miles west of Ayutla, *Cronquist 9790* (MICH, NY); above Ahuacapán, *McVaugh & Koelz 975* (MICH). MICHOACAN: Tancítaro, *Hinton 15694* (GH, TEX); south of Uruapan, *King & Soderstrom 4735* (F, TEX); east of Morelia, *King & Soderstrom 5090* (F); Coalcomán, *Hinton 12431* (F, MICH, NY, US, W), *12907* (GH, NY, US); Morelia, *Arsène 3175* (US); Morelia, Cerro Azul, *Arsène 7334* (US); Morelia, Loma Sta. María, *Arsène 5861* (NY, US), *5874* (GH, US), *6615* (US), *6985* (US), *8586* (NY); Quiroga, *Ripley & Barneby 14130* (NY). MEXICO: Temascaltepec, *Hinton 2718* (GH, NY), *2929* (US), *5256* (GH, US). GUERRERO: Dist. Mina: Pilas, *Hinton 9868* (GH); Manchón, *Hinton 11293* (GH); Teotepec, *Hinton 14805* (GH, NY, US); Petlacala, *Mexia 9101* (F, GH, NY, US). OAXACA: Reyes [10 mi N E of Cuicatlán], *Nelson 1715* (US). VERACRUZ: Orizaba, *Botteri 478* (US), *500* (GH), *865* (GH, US). CHIAPAS: Mt. Pasitar, *Matuda 747* (MICH, US); Mpio. Tenejapa, *Breedlove 12551* (F, MICH).

GUATEMALA: ALTA VERAPAZ: *Stuessy 595* (TEX), *Standley 71022* (F), *71034* (F), von Tuerckheim [*J. D. Sm. 387*] (GH, US), *II. 1291* (F, GH, MICH, NY, US, W). CHIMALTENANGO: *J. R. Johnston 499* (NY), *Standley 59108* (F), *79927* (F). GUATEMALA: *Standley 59264* (F, NY). HUEHUETENANGO: *Standley 82133a* (F). SOLOLA: *Steyermark 47324* (F, GH).

EL SALVADOR: SAN SALVADOR: *M. C. Carlson 405* (F).

COSTA RICA: Zarcero, *Austin Smith H33* (F), *A619* (F, GH); Hatillo, *F. Solís 53* (F); bords du Río Torres, *Tonduz [Pitt. & Dur. Pl. Cost. Exs. 8961]* (GH, US); Prov. San José, *Standley 32576* (US), *42123* (US).

COLOMBIA: ANTIOQUIA: Angelopolis, *R. A. Toro 915* (NY). CALDAS: Chinchiná, *Cuatrecasas 23371* (F); Salento, *Pennell et al. 8743* (NY). CAUCA: Popayán, *S. Yepes A. 125* (F), *Lehmann 6083* (F).

PERU: Peruvia subandina, pr cultis ad Pampagaio, *Poeppig 1772B* (W, type). JUNIN: Utcuyacu, *F. Woytkowski 35367* (F), *37029* (F).

The following collections differ from those cited above in having the phyllaries less glandular than usual, the outer series usually evidently pilose with simple hairs and often markedly reflexed, and the inner series nearly glabrous; the achenes tending to be dimorphic, those of the rays dorsiventrally compressed, 2.5 mm long, those of the disk nearly square, 1.5 mm long. Vegetatively these plants are like those of *S. agrestis* except that the leaves are more sharply serrate than usual:

MEXICO: MICHOACAN: Zitácuaro, *Hinton 11852* (F, GH, MICH, NY, W). MEXICO: Temascaltepec, *Hinton 1925* (NY, US), *5310* (GH, NY).

In the mountains of Hispaniola there is a native *Sigesbeckia* that appears to represent an insular population of *S. agrestis.* We have seen few collections, and these in different stages of development:

HAITI: Furcy, 1300 m, *Leonard 4646, 4652* (both NY); Mornes des Commissaires, 1600 m, *Holdridge 932* (F, NY). REP. DOMINICANA: Prov. San Juan, *R.A. & E.S. Howard 9404* (NY); prope Constanza 1190 m in pineto, *von Tuerckheim 2935* (NY, W).

3. **Sigesbeckia** [*Siegesbeckia*] **jorullensis** HBK. Nov. Gen. & Sp. 4: 284. 1820. *Siegesbeckia* [sic] *cordifolia* HBK. Nov. Gen. & Sp. 4: 283. 1820. *Polymnia odoratissima* Sessé & Moc. Pl. Nov. Hisp. 148. 1890.

A plant chiefly of humid mountain forests at high elevations, ranging from Mexico through Central American to the Andes. In Mexico it is found often in fir (*Abies*) forest, or in pine-fir, pine-*Cupressus* or *Cupressus* forests, often in dense shade, sometimes a weed of roadsides or clearings, mostly at elevations of from 2500 to 3500 m but occasionally as low as 1300–1500 m. It is little known in western Mexico, but is more common in the high mountains from Mexico City eastward and southeastward through Central America. The habitat in South America is variously described by collectors as "forest," "moist forest," "bushy slopes" or "open places"; apparently many collections from the Andes represent weeds of cultivation or ruderals.

The North American representative of this species-complex is described below. It does not appear to be especially variable. Essentially indistinguishable populations occur in many localities along the Andes from Colombia and Venezuela to Argentina and Chile, within approximately the same altitudinal limits as the North American plant, and it seems reasonable to regard the North and South American populations as conspecific. We should include among these *Sigesbeckia cordifolia* HBK., of which the type came from near Bogotá, Colombia. It was distinguished from *S. jorullensis* chiefly by having more numerous ("16–20") disk flowers. We do not consider this in itself sufficient to justify the separation of two species. It is true that among the South American material specimens with numerous disk flowers occur more often than among the North American, and doubtless this is of taxonomic significance. Full consideration of this is not possible at this time, and we have therefore treated the South American taxa cursorily, merely suggesting that most of them are probably not specifically different from *S. jorullensis.* There appears to be considerably more variation, both vegetative and in characters of flowers and fruit, among South American populations than in North America. Most specimens have the coarsely glandular phyllaries and green anthers of *S. jorullensis,* but there is a diversity of leaf-form, as well as the variation in number of disk-flowers mentioned above. An occasional specimen may have yellow anthers or gland-dotted leaves (as in *S. agrestis*) but otherwise appear typical of the *jorullensis* group. Perhaps these two species hybridize where their ranges approach one another; in any event a more intensive study of the South American plants is needed.

The type-locality of *S. jorullensis* was published as "in monte ignivomo Mexicano, Volcan de Jorullo, alt. 530 hex." It is unlikely that the specimen collected by Humboldt and Bonpland actually came from this low elevation on the Volcán de Jorullo, which was visited by Humboldt and Bonpland just before they returned to Mexico City by way of the Nevado de Toluca. *Sigesbeckia jorullensis* is a plant of high-altitude, humid coniferous forests, and is well known from both the Nevado de Toluca and from the high mountains surrounding the Valley of Mexico. At the time Humboldt and Bonpland visited Jorullo, the volcano was less than 50 years old, having erupted violently in 1759. It is located at the edge of the hot lowlands of the Balsas valley, and even today provides no very suitable habitats for mesophytic or high-altitude species. It is probable that the plants collected by Humboldt and Bonpland during this the latter part of their journey of September, 1803, were hastily labelled and bundled together in such a way in the field that definite localities could not be assigned to them later except from memory.

A fibrous-rooted, single-stemmed, short-lived perennial or perhaps annual herb up to 1 m high or more, the stem up to 6–7 mm thick at base, repeatedly forked at the apex with a terminal, nodding, long-pedunculate flower in each fork, usually with strong ascending lateral branches from the nodes below the lowest fork; lower stems sparingly pilose to hirsute with hyaline multicellular taper-pointed collapsing hairs up to about 2 mm long; cells of the large hairs (or at least 6–10 of the basal cells) short, less than twice as long as wide; leaves with some similar, mostly smaller hairs on the veins beneath and some stiffer hairs above, the lower surface without resinous dots; upper branches, peduncles and involucre stipitate-glandular, the gland-tipped hairs mostly 0.5 mm long or more; leaves strictly opposite, with broad auriculate or subclasping bases, the upper generally lanceolate and sessile, the others with ovate to deltoid or cordate blade and margined petiole; blades of the principal leaves (3–) 5–8 (–12) cm long, 2.5–8 cm wide, triplinerved, coarsely or very shallowly and sinuately serrate, acuminate or especially the lower acute; upper leaves mostly rounded at base to a broad petiole much shorter than the blade; lower leaves often truncate or subcordate, the margins decurrent onto winged petioles 3–6 mm wide, tapering to the expanded base, 2–7 cm long, often 1/2–3/5 as long as the blade; bracteal leaves lanceolate, the upper much reduced; heads (except for the long outer phyllaries) inconspicuous, 3–5 mm high, 5–7 mm wide in fruit, forming a loose irregular panicle, solitary in the forks and at the tips, often 50–100 in all, on slender uncinate peduncles 1–2 cm long (or the central ones 3–4 cm long); outer phyllaries loosely spreading, 5 (–6), (5–) 8–20 mm long, usually very narrowly linear-spathulate with expanded tip 0.5–1 mm wide, coarsely stipitate-glandular on the margins and adaxially, but without eglandular hairs; inner phyllaries usually 8, 2–3 mm long, green or purplish, glandular, obovate, acuminate, each obtusely keeled and appressed to a ray-achene; pales like the inner phyllaries but narrower, thinner, scarious, greenish and glandular at tips only; ray-florets usually 8, the tube 0.8–1.5 mm long; ligule 1.5–2 mm long, yellow or often drying red-purple, the lobes 0.3–0.7 mm long; disk florets (?8–) 13 (–18), yellow, the tube 0.6–1 mm long, the throat broad, 0.5–0.7 mm long, 0.5 mm wide, the lobes 0.5 mm long; anthers green, about 0.8 mm long including the ovate acute appendages; style-branches 0.5 mm long; achenes nearly black, 2.3–2.7 mm long, obtusely 4-angled and laterally compressed, 1–1.5 mm wide in the broadest dimension at the truncate apex, curved to the narrow tapering base, striate but not ribbed, with flat circular apical scar; receptacle conic, as broad as long.

Specimens examined (MEXICO):

CHIHUAHUA: Mojarachic, *Knobloch 5413* (F); Arroyo Ancho ["Aucho"], *Pringle 1283* (F, GH, MICH, NY, US). DURANGO: near El Salto, *McVaugh 21740* (MICH). JALISCO: Volcán Tequila, 2700 m, *Webster & Breckon 15917* (MICH). MICHOACAN: Pátzcuaro, *King & Soderstrom 5194* (MICH, NY, TEX, US); Zitácuaro, *Hinton 13232* (GH, MICH, TEX, W), *Weber & Charette*

11884 (MICH). EDO. DE MEXICO: Temascaltepec, *Hinton 1904* (NY), *2862* (NY, US), *3047* (US), *8396* (GH, US), *5148* (US); Nevado de Toluca, *Rose & Painter 7911* (NY, US); "Volcán de Jorullo," *Humboldt & Bonpland* (P, type); Criadero de Trucha, *Matuda 19398* (US); Amecameca-Popocatepetl road, *Beaman 2128* (US). DISTRITO FEDERAL: Desierto de los Leones, [many collectors]; San Agustín, *Schaffner s.n.* (GH); La Venta, *Schiefer 131* (GH); Santa Fe, *Bourgeau 735* (US); "Ajusca Mountains," *Lemmon & wife 78* (GH). MORELOS: ["Ayacapixtla et Tlaltenanco"], *Sessé & Mociño 3974* (MA, type of *Polymnia odoratissima*; F). HIDALGO: Trinidad Iron Works, *Pringle 13082* (F, GH, MICH). PUEBLA: Boca del Monte, *Arsène 2140* (GH, US). VERACRUZ: Acultzingo, *A. J. Sharp 44819* (NY); Jalapa, San Miguel, *Balls 4725* (US); Mt. Orizaba, *Balls & Gourlay 5280* (F, US), *Liebmann 224* [8837] (US). GUERRERO: Mpio. Chichihualco, *Feddema 2763* (MICH); Dist. Galeana, *Hinton 14745* (GH, NY, US). OAXACA: Without locality ["mountains"], *Cuming* (GH), ["1750 m."], *Conzatti & González 1001* (GH, US); Cerro de San Felipe, *Conzatti & González 561* (F, GH), *C. L. Smith 613* (TEX, US); Zimatlán, Sta. Inés del Monte, *Conzatti & Gonzalez 1341* (GH); Mt. Zempoaltepetl, *Nelson 572* (US); 35 miles south of Valle Nacional, *Cronquist 9641* (MICH, NY, TEX, US). CHIAPAS: Mpio. de Chamula, *Breedlove 6705* (F, MICH), *Breedlove & Raven 13746* (MICH); Mpio. de Tenejapa, *Breedlove 7004* (F, MICH), *Breedlove & Raven 12951* (MICH); Mpio. de Zinacantán, *Breedlove 7970* (F, MICH); Mt. Male, *Matuda 4606* (F).

Selected specimens examined (Central America):

GUATEMALA: JALAPA: *Steyermark 32653* (F), *Salas 656* (US). QUICHE: *Heyde & Lux [J. D. Sm. 3384]* (F. GH, US). SOLOLA: *Williams et al. 25407* (F). Also numerous collections from Departments of Chimaltenango, Huehuetenango, Quezaltenango, Sacatepéquez, San Marcos, Totonicapán.

COSTA RICA: Volcán Irazú (many collectors); Volcán de Turrialba, *Standley 34936* (US); Cerro de Buena Vista, *Pittier 3409* (GH, US); Laguna de Barba, *Pittier 1903* (GH); El Copey, *Tonduz 11910* (US); Prov. de San José, *Williams et al. 24368* (F, US, W), *Standley 42560* (US), *Standley & Valerio 43528* (GH, US).

PANAMA: CHIRIQUI: Bajo Chorro, *Davidson 150* (F, GH, US).

THE GENUS *TRIGONOSPERMUM* LESS. (COMPOSITAE, HELIANTHEAE)

by

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The genus *Trigonospermum* Less. was long thought to include but two Mexican species, *T. adenostemmoides* Less. (Syn. Gen. Comp. 214. 1832), and *T. melampodioides* DC. (in DC. Prodr. 5: 509. 1836). Several other Mexican species, however, have been proposed as new since 1890. In our opinion the genus consists of four recognizable taxa, two of which seem never to have been described.

The following synopsis is based on field observations particularly in western Mexico, and on herbarium specimens. We have studied jointly all the material in the herbarium of the Field Museum (F), the herbarium of Harvard University (A, GH), the University of Michigan Herbarium (MICH), the New York Botanical Garden (NY), and the United States National Herbarium (US). One of us (McVaugh) has studied selected specimens in the herbaria at Geneva (G, G-DC) and Paris (P). To the authorities at these institutions we express our appreciation for loans of material and for other courtesies. Publication of this paper was supported by the National Science Foundation (Grant GB-5218X, to McVaugh).

Trigonospermum Less. Syn. Gen. Comp. 214. 1832.

Annual or perennial suffrutescent herbs or nearly unbranched shrubs, pubescent, usually stipitate-glandular at least in the inflorescence; leaves opposite, rhombic-ovate to elliptic, dentate, setose with rigid basally swollen hairs, prominently triplinerved, the margins long-decurrent at base and forming a broad triangular extension of the base of the blade; inflorescence compound, subcorymbose, many-headed, not leafy; heads small, hermaphrodite, heterogamous, consisting of few—numerous functionally staminate disk flowers on a convex receptacle and 1—10 fertile (pistillate) ray flowers; involucre biseriate, the outer phyllaries linear to narrowly elliptic, commonly alternating with the carinate, obovate, acuminate, inner ones; inner phyllaries each clasping the two abaxial faces of an achene, and deciduous with it; pales scarious, of two kinds, the outer mostly obovate, 5—9-nerved, each appressed to an achene but not deciduous with it; inner series narrow, at most 1-nerved, each subtending the sterile stalk of a disk flower; rays yellow or white, deeply 3-lobed; disk flowers often darker than the rays, 5(—4)-lobed; pappus none; anthers usually as many as the corolla-lobes; achenes black, lustrous, ellipsoid to broadly obovoid or biconvex, obtusely 3-angled, 7—11-striate on each face.

In most general treatments of the Compositae, *Trigonospermum* has been placed near *Polymnia,* which it resembles in having sterile disk-flowers. Superficially the species of *Trigonospermum* are much like those of *Sigesbeckia,* which is usually allied with another series of genera because the disk-flowers are fertile. Probably the relationships should be re-assessed in the group that includes at least *Sigesbeckia, Rumfordia, Polymnia* and *Trigonospermum,* and perhaps other genera.

Key to the Species

1. Broad outer pales densely appressed-pubescent on one side near tip, appearing fimbriate-tipped; ray-flowers mostly 5—8.5 mm long, much exceeding the involucre; disk-flowers 19—41 (—55), densely pubescent on the outer surface of the lobes; achenes 1.9—2.7 mm long, truncate or the apex depressed, the terminal scar chiefly of two concentric rings; plant a subshrub up to 4 m high or more; mountains, mostly of the Pacific Slope, Guatemala to Durango. *T. melampodioides.*

1. Broad outer pales essentially glabrous, sometimes with a few stout hairs near tips, or sparingly ciliate; ray-flowers 4 mm long or less, rarely more than twice as long as the involucre; disk-flowers 8–10 (–13) or, if 17–22, glabrous or essentially so; achenes various, the style-base persistent as a rounded, oblique or amorphous protuberance; plants as far as known annuals 1 m high or less.
   2. Narrow outer phyllaries strongly reflexed; disk flowers 17–22, not jointed at the base of the tube; outer pales scarcely larger than the inner, not inclosing the achenes, abaxially convex; styles of the disk-flowers bifid; ligule standing nearly at right-angles to the tube, with broad rounded basal rim surrounding the style; achenes dorsally compressed and biconvex, or the inner face angled; Pacific slope of western Guerrero. *T. blakei.*
   2. Narrow outer phyllaries appressed to the involucre until the achenes fall; disk-flowers 8–10 (–13), jointed at the base of the tube, the filiform stipes persistent after the flowers fall; outer pales obovate, much wider than the linear or filiform inner ones, abaxially concave, inclosing the achenes but not falling with them; styles of the disk-flowers undivided; ligule narrowed to the base, its long axis continuing that of the tube; achenes trigonous or ellipsoid.
      3. Broad outer pales eciliate, but somewhat erose at tips, 1.8–2.5 (–3) mm long; broader phyllaries 2.5–3.5 mm long; achenes (including the persistent style-base) 1.8–2.4 mm long, broadest near the apex; region of Orizaba and Jalapa, Veracruz. *T. adenostemmoides.*
      3. Broad outer pales sparingly slender-ciliate at the erose tips, 2.5–4 (–5) mm long; broader phyllaries 3.5–5.5 mm long; achenes (including style-base) 3–4 mm long, broadest at or slightly above the middle; central Mexico, mostly at elevations of 1900–2500 m, from near Mexico City to San Luis Potosí and Sonora. *T. annuum.*

1. **Trigonospermum adenostemmoides** Less. Syn. Gen. Comp. 214. 1832.

Probably an annual, up to 80 cm high or more, unbranched except in the inflorescence; rigid inflated hairs abundant on the leaves; sessile foliar resiniferous glands none; inflorescence branches bearing few inflated flaccid hairs and many multicellular gland-tipped hairs; leaves 6–10 cm long, 4–6 cm wide; margins shallowly and rather uniformly serrulate (except on the basal angles and the decurrent base) with 20–30 low callose teeth on each side; heads in flower about 3 mm long, in fruit 3.5–4 mm long; outer phyllaries 1–1.5 mm long; inner phyllaries 2.5–3.5 mm long, 2.5 mm wide, apiculate, glabrous except for a few inflated hairs on the backs; outer pales (1.8–) 2.5 (–3) mm long, 1.3–1.5 mm wide, nearly white, 5- to 7-nerved, glabrous, erose at the rounded apex; inner pales filiform, 1 mm long or less, a little shorter than the stalks of the disk flowers; ray flowers 3 (?), about 2 mm long; disk flowers 8–10; achenes 1.8–2.4 mm long, 1.1–1.3 mm wide, turbinate, 3-angled, broadest near the apex, truncate with rounded elevated style base 0.1–0.3 mm high; basal scar callose, unilateral.

Known only from the type-region, in the foothills of central Veracruz at low elevations, between Orizaba and Jalapa.

VERACRUZ: Tocuila al N. de Orizaba, 19 Nov 1967, *Rosas R. 780* (GH, MICH); near Orizaba, May 1856, *Schaffner 325* (P); Orizaba, Nov 1854, *Botteri 1189* (G, MICH, P); Río Blanco, région d'Orizaba, 24 Jul 1866, *Bourgeau 2691* (P); San Cristóbal, Orizaba, *C. Mohr 255* (US); Xalapa, *Galeotti 4079* (P); without locality, *Schiede 215* (P); without locality, *ex herb. Sch. Bip.* (P).

Because this plant is poorly represented, even in most of the larger herbaria, the correct application of the epithet *adenostemmoides* has been unknown to most botanists. The plant described below as *Trigonospermum annuum* has mostly passed under the name of *adenostemmoides.* The latter is not precisely identifiable from the original description, which is very generalized. No definite type-locality is given; Lessing says merely that the plant is Mexican in origin, and that it was sent to him by Schiede. The plant is described as annual, and the heads are said to be "minutis." Schlechtendal (Linnaea 9: 267. 1834) described, under the name of *T. adenostemmoides,* a Schiede specimen presumably collected near Jalapa, stating that this was one of a series listed on the basis of determinations made by Lessing ["E schedis a Lessingio relictis"]. Presumably it was this reference by Schlechtendal that led

DeCandolle (in DC. Prodr. 5: 508. 1836) to cite *T. adenostemmoides* as from near Jalapa. We have not seen any specimen identifiable as Lessing's type, nor the Schiede specimen described by Schlechtendal (which conceivably could be the type, as Schiede's collections were handled and distributed chiefly by Schlechtendal). It may be noted, however, that there is a Schiede specimen at Paris, which confirms the assumption that he did collect this particular species; we have not seen any other specimens of *Trigonospermum* collected by Schiede, and the probability seems to be that the plant described by Lessing is the one we are calling *adenostemmoides*. No other species of the genus is known to occur in the same region. Many of Schiede's early collections in Mexico were from the lowlands of Veracruz, so it seems likely that

FIG. 60 (above). Distribution of *Trigonospermum melampodioides* in Mexico (one Guatemalan locality not shown).

FIG. 61 (below). Distribution of *Trigonospermum annuum* (one locality in Sonora not shown), *T. adenostemmoides* (A), and *T. blakei* (B).

if he collected the type of *T. adenostemmoides*, it represented this same small-flowered species that grows around Orizaba and Jalapa.

2. **Trigonospermum annuum** McVaugh & Laskowski, sp. nov.

Annuum, 0.3–1 m altum, puberulum, ramulis glandulosis; folia caulinia, elliptica vel ovata, acuminata, basi obtusa vel cuneata, supra scabra vel hispidula, subtus pallidiora et strigosiuscula, marginibus serrulatis vel subintegris, petiolis usque ad 2.5 cm longis, basi connatis; rami florescentes ascendentes longi, e foliorum caulinium axillis oriundi, capitulis pauciusculis, cymosis, tenuipedunculatis, 2.25–5 mm longis; phyllaria exteriora angusta (4–) 5, appressa, 0.5–1 mm lata, interiora 3.5–5.5 mm longa, 3–4 mm lata, apiculata; paleae exteriores 2.5–4 (–5) mm longae, apice ciliatae, obovatae, quam interiores multo latiores, abaxiale concavae et achaenia plusminusve involventes sed cum eis non caducae; paleae interiores filiformes linearesve; flores radii saepe 3, subrecti, 1.5–3 (–4) mm longi, ligulis flavis obtuse trilobatis, basi angustatis non deflexis; flores disci 8–10 (–13), basi geniculati, stipitati, stipitibus post anthesin persistentibus, stylis indivisis; achaenia subtrigona, 3–4 mm longa, elliptica usque ad obovoidea, apice rotundata vel truncata.

Annual herbs 0.3–1 m tall, with taproot 1.5–7 cm long, the stem unbranched except as part of the inflorescence; stem sometimes purple-tinged, up to 5 mm thick at base, unevenly shallowly sulcate, puberulent except at the very base, the inflorescence branches bearing few inflated flaccid hairs, and numerous multicellular gland-tipped hairs 0.2–0.4 mm long; nodes 5–8 below the inflorescence, the upper ones leaf-bearing at flowering time, the largest leaves at or above the middle; principal leaves (3–) 5–10 (–15) cm long and (1.3–) 2–6.5 (–9) cm wide; blades elliptic to ovate, acuminate, scabrous to hispidulous above with inflated hairs, paler below and rather sparsely strigose especially along the veins, usually dotted with sessile resinous glands, obtuse or cuneate at base, the margins decurrent on the petiole for 0.5–2 cm below the juncture of the lateral veins; margins shallowly and uniformly serrulate (except on the basal angles and the decurrent base) with 5–21 (–32) teeth on each side, or the teeth few and shallow and the margins appearing subentire; unmargined petioles up to 2.5 (–3.5) cm long, sometimes marginally pilose, connate at base; heads relatively few, on slender and usually drooping peduncles, in cymes at the tips of long ascending branches arising from the axils of almost all the foliage leaves, the terminal branches sometimes subtended by much reduced leaves but not forming a conspicuous terminal inflorescence; heads 2.25–5 mm long in flower, longer in fruit; outer phyllaries (4–) 5, mostly 2.5–3.5 mm long and 0.5–1 mm wide, puberulent and often glandular; inner phyllaries (in fruit) 3.5–5.5 mm long, 3–4 mm wide, apiculate, strigose and usually glandular; outer pales 2.5–4 (–5) mm long, 2–2.5 mm wide, nearly white, scarious, 5- to 9-nerved, erose and very sparsely ciliate at the rounded apex; inner pales scarious, filiform to linear, 1.25–2.3 mm long, usually a little longer than the stalks of the disk flowers; ray flowers commonly 3, 1.5–3 (–4) mm long and 3–4.5 mm wide, with obtuse lobes 1.5–2.25 mm long, resinous-dotted, the tube 0.4–1 mm long; style-branches 0.6–1 mm long; disk flowers (1–) 8–10 (–13), 1.5–2 mm long, funnelform, resinous-dotted and with few scattered hairs; lobes 4–5, 0.2–0.35 mm long, acute; anthers 4–5, 0.5–0.7 mm long, appendaged 0.15–0.23 mm, not exserted; achenes as many as the ray flowers or fewer, 3–4 mm long, 1.65–2.2 mm wide, broadly elliptic or obovate in outline, broadest at or slightly above the middle, rarely near the rounded or sometimes truncate apex, tipped by the convex style-base 0.2 mm high.

Moist places among fields and hills, along creeks and in humid ravines, 1200–2500 m in elevation, mostly on the Central Plateau of Mexico from the State of México and Michoacán to San Luis Potosí and Sonora. Fruiting and flowering

FIG. 62. Habit and floral details of *Trigonospermum. Trigonospermum annuum (McVaugh 23841),* habit, about half natural size, drawn by Karin Douthit. Above, right, head enlarged, with facing ray-flower removed; achene and outer pale, X10. *T. melampodioides,* below, right, head enlarged, with facing ray-flower removed; achene and outer pale, X10. Heads and floral details drawn by Laskowski, from *Pringle 4568 (T. annuum), McVaugh 14058 (T. melampodioides)* and *Bourgeau 809* (same, the pale).

specimens have been collected in September and October, some weeks earlier than the usual fruiting period of *T. melampodioides*.

MEXICO: DISTRITO FEDERAL: Pr[ès] Tacuba, Sep [18]55, *Schaffner 248* (GH, P).
DURANGO: Beside a creek, Nov 1896, *E. Palmer 852* (GH, US).
GUANAJUATO: Near Acámbaro, 6 Oct 1892, *Pringle 5307* (GH).
HIDALGO: Regla, *C. Ehrenberg 448* (P).
JALISCO: SE of Mezquitic, 14 Sep 1966, *Anderson & Laskowski 3628* (MICH); barranca of Tequila, 4 Oct 1893, *Pringle 4568* (F, GH, MICH, type; NY, P, US); NE of San Juan Cozalá, 11 Sep 1967, *McVaugh 23841* (MICH).
MEXICO: Montagne près de Guadalupe, Vallé de Mexico, 24 Aug 1865, *Bourgeau 809* (G, GH, MICH, P); Tultenango Station, 9 Oct 1902, *Pringle 9938* (F, GH).
MICHOACAN: NE of Cotija de la Paz, 1 Dec 1970, *McVaugh 24910* (MICH); Cerro de las Nalgas, vicinity of Morelia, 1900 m, 9 Sep 1909, *Bro. G. Arsène s.n.* (US); Rincón, près Morelia, 19 Sep 1909, *Arséne 2547* (P); Punguato, vicinity of Morelia, 2200 m, 5 Sep 1912, *Arsène s.n.* (US).
SAN LUIS POTOSI: Chiefly in the region of San Luis Potosí, 22°N. Lat., 6000–8000 ft., 1878, *Parry & Palmer 432* (GH, NY, US); Cultivated from seed, Davenport, Iowa, United States, 1879, *Parry & Palmer 432* (F).
SONORA: Rincanarda [sic] Mts., 27 Nov 1890, *C. E. Lloyd 418* (GH, NY, US).

3. **Trigonospermum blakei** McVaugh & Laskowski, sp. nov.

Annuum, ut videtur 50 cm altum, pro genere sparsim pilosum, caulibus dichotomis, inflorescentiis diffusis paucicapitatis; folia ovata, 6–7 cm longa, sensim acuminata, basi attenuata, marginibus serrulatis; capitula 8–10 mm lata, phyllariis exterioribus linearibus 5, valde reflexis, interioribus obovatis, acuminatis, basi saccatis; paleae 2–2.5 mm longae, acutae, exteriores eciliatae, quam interiores vix majores, cucullatae, abaxiale convexae, achaenia non involventes; flores radii 5, ligulis albis subpersistentibus trilobatis abrupte deflexis; flores disci 17–22, stylis bifidis; achaenia compressa, ambitu obcordata, biconvexa vel superficie interiore obtuse angulata, apice styli base rotunda coronata.

Probably annual, said to be 50 cm high, very sparingly pubescent for the genus, the leaves nearly glabrous, with a few flaccid broad-based hairs especially on the veins, and a row of similar hairs on the line joining the leaf-bases; stem nearly glabrous except in the smallest branches of the inflorescence and the filiform peduncles, the latter with numerous short gland-tipped hairs and a few flaccid inflated hairs; stems 4 or 5 times dichotomous above the middle, the diffuse inflorescence 25–30 cm high and wide, with few heads on very slender but scarcely nodding peduncles 10–15 mm long, and the main branches subtended by foliage leaves successively reduced in size above; principal leaves 6–7 cm long, 3–3.5 cm wide, ovate, gradually acuminate, resinous-dotted beneath, rounded abruptly toward the attenuate petiolar base, the margins decurrent nearly the whole length of the petiole, then abruptly narrowed and rounded off at the very base; margins finely and distantly serrulate with about 15 teeth on each side, the proximal half of the blade nearly or quite entire; heads in flower 8–10 mm wide; outer phyllaries usually 5, linear, ciliate, 0.8–1.3 mm long, strongly reflexed and appressed to the peduncle; inner phyllaries obovate, acuminate, 2.5–3 mm long, 1.5–1.8 mm wide, hispidulous on the outer surface near tips, saccate at base; pales 2–2.5 mm long, acute, 1-nerved, entire, acute, at least the outer ones with a few bristles near tip but not ciliate; outer pales narrowly obovate, cucullate, 1.5 mm wide near tips, the inner ones half as wide, linear, nearly equalling the flowers; ray flowers 5; ligules white, subpersistent on the achenes, glabrous, 4 mm long with 3 oblong obtuse ascending lobes 1.5–2 mm long, standing at right angles to the tube, with broad rounded basal rim; tube less than 0.5 mm long, densely and softly pale-hirsute; style-branches about 0.5 mm long; disk flowers 17–22, about 2 mm long, the campanulate throat about as long as the slender tube, the lobes about 0.5 mm long, deltoid, roughened within; styles bifid; anthers about 0.5 mm long, included; achenes obcordate in outline, biconvex or the inner face with an obtuse central angle,

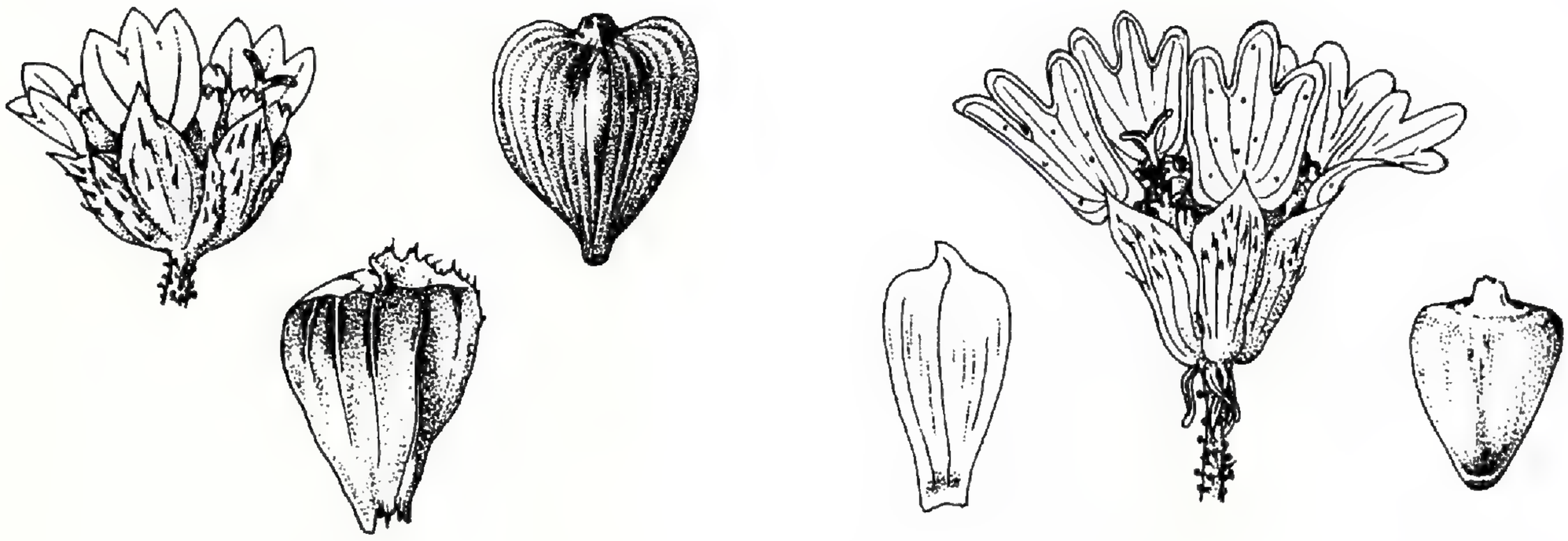

FIG. 63. *Trigonospermum. T. adenostemmoides* (at left): Flowering head, enlarged (*M. Rosas R. 780*); achene (*Schiede 215*) and outer pale (*Rosas 780*), X10. *T. blakei* (at right; *Hinton 14706*, type): flowering head, enlarged; achene and outer pale, X10. Drawings by Laskowski.

1.5 mm long, 1.2 mm wide, 0.7 mm thick, broadest at the truncate apex, and there tipped by the prominent rounded pale style base 0.2–0.3 mm high.

"Mixed forest," at an elevation of 850 m, Dist. Galeana, Guerrero, Mexico; known only from the type-collection.

MEXICO: GUERRERO: Dist. Galeana, Carrizo to Santo Domingo, elev. 850 m, 24 Nov 1939, *Hinton 14706* (MICH, type; GH, NY, US).

This extraordinary plant was recognized as a new species of *Trigonospermum*, but never described as such, by the late S. F. Blake. It differs in so many respects from all the known species of *Trigonospermum* that it would be unthinkable to relate it to any of them. It is possible that it represents some other genus–perhaps even an undescribed genus–but in aspect, in kinds and distribution of glandular and non-glandular pubescence, in leaf-form, venation and serration, and in the morphology of the involucre, as well as in the more technical characters of fertile ray-flowers, sterile disk-flowers, and achenes falling with the loosely inclosing inner phyllaries, it is typically a *Trigonospermum*. It differs from the other known species of that genus in the ways noted in the key above, none of which by itself seems very important, but which taken together make this, to say the least, an unusual *Trigonospermum*.

4. **Trigonospermum melampodioides** DC. in DC. Prodr. 5: 509. 1836. *Eriocephalus trinervatus* Sessé & Moc. Pl. Nov. Hisp. 150. 1890. *Trigonospermum tomentosum* Rob. & Greenm. Proc. Am. Acad. 32: 44. 1896. *Trigonospermum floribundum* Greenm. Proc. Am. Acad. 39: 99. 1903. *Trigonospermum hispidulum* Blake, Jour. Wash. Acad. Sci. 19: 272. 1929.

Perennial suffrutescent herbs or few-branched shrubs 0.6–4 m tall, the stems up to 5 cm thick at base, finely sulcate at least in the upper branches, glabrate below, sparsely to copiously hispid in the inflorescence with broad-based flaccid hairs, and there also beset with yellow to dark brown or purple glands which vary from nearly sessile to long-stalked, the stalks up to 0.8 mm long; principal blades (6–) 8–12 (–24) cm long and (2.5–) 5–7 (–13.5) cm wide, broadly ovate to rhombic-ovate, sometimes broadly elliptic, roughened above with many rigid broad-based hairs, sparsely to copiously hirtellous, sericeous or tomentose beneath, often minutely resinous-dotted, acuminate at tip, at base from acute to obtuse or almost truncate, the margins cuneately decurrent for a distance of 0.5–2.5 (–5) cm below the juncture of the lateral veins; margins uniformly or irregularly serrulate or denticulate with 15–35 (–60) teeth on each side, these mostly on the distal margins but also occurring sparingly on the proximal margins and the decurrent base; blades sometimes very unevenly dentate or denticulate, or with small lobes especially near the widest part, the

leaves then subhastate; unwinged part of the petiole almost none or 0.5–1.5 cm long, commonly sparsely pilose along the margins; inflorescence consisting mostly of a terminal corymbiform cyme, many-headed, the ascending flowering branches mostly from the axils of the uppermost 1–2 pairs of leaves; peduncles scurfy-puberulent or -hispid with short inflated hairs mixed with sessile to stipitate glands (these variable in abundance but more densely concentrated here than in the lower inflorescence-branches); heads at anthesis 2.5–6 mm long; outer phyllaries 5 (–8), linear, (1.2–) 2.5–3.5 (–4.1) mm long, almost glabrous to hirtellous, ciliate, often gland-dotted; inner phyllaries (4–) 5 (–10), 2.5–3.5 mm long, obovate, more or less keeled, more pubescent than the inner ones, the apex fimbriate-ciliate and cuspidate-acuminate; outer pales obovate, 1.8–3 mm long, scarious or sometimes purple-tinged, mostly 9- to 11-nerved, fimbriate at the truncate or rounded apex and appressed-pubescent adaxially near the tip; inner pales filiform to subulate, 1.25–2 mm long, 1-nerved, fimbriate especially at apex; ray-flowers (4–) 5 (–10), mostly 5–8.5 mm long, the ligule 4.5–9.5 mm wide, gland-dotted on the abaxial surface, 8- to 11-veined, with rounded lobes 2–3.5 mm long and tube 0.5 mm long or less; style-branches 1–1.6 mm long; disk flowers 19–41 (–55), 1.5–2.8 mm long, campanulate above a tubular base 0.5–0.75 mm long; lobes (4–) 5, 0.3–0.6 mm long, deltoid or narrower, acute; anthers (4–) 5, 0.75–1.3 mm long, often exserted over half their length; achenes as many as the rays (or by abortion fewer), (1.5–) 2–2.7 (–3.3) mm long and about two-thirds as wide, turbinate and bluntly 3-angled, broadest near the apex and there truncate or concave; circular scar left by the corolla base pale, prominent, surrounding the circular remains of the style-base, the terminal scar as a whole depressed or rarely slightly elevated.

Forests of pine, pine-oak, fir, or mixed coniferous and broad-leaved trees, often in *barrancas* or on steep well-drained slopes, sometimes in wetter places along streams, mostly 1700–2800 meters, occasionally at lower elevations, flowering from May to January or throughout the year. Guatemala; Oaxaca to the State of Mexico, Jalisco, Sinaloa and Durango.

This species is variable with respect to pubescence (especially of the lower, or abaxial, leaf-surface), toothing and lobing of leaf-margins, and number of achenes and inner phyllaries. None of these characters, however, seems to be correlated with others in such a way as to suggest that more than one species is involved in the complex. The types of *Eriocephalus trinervatus, T. tomentosum,* and of *T. melampodioides* itself, are relatively heavily pubescent; similar plants occur occasionally throughout the range of *T. melampodioides* (sens. lat.), without geographical segregation as far as we can tell.

The type of *T. hispidulum* is characterized by having somewhat irregularly toothed leaves which are subhastate, with small acute toothlike lobes near the widest part of the blade; the pubescence is relatively scant, a little harsher than in plants like the type of *T. tomentosum,* and the ligules are smaller than the average in *T. melampodioides.* A few other plants from western Jalisco (e.g. *McVaugh 13739, 14088*) are similar to the type, but at least some larger-flowered plants with non-hastate leaves are known from the same region, and unless further investigation there indicates the existence of a distinct allopatric population of the *hispidulum* type, it is best to treat the latter as merely an extreme of the polymorphic *T. melamopioides.*

The most common number of ray flowers is five. Specimens bearing more than five ray flowers and achenes per head are occasional in all parts of the range. Proliferation of ray flowers and achenes occurs in isotypes of *T. tomentosum* as well as in isotypes of *T. hispidulum.* The supposedly distinctive features of *T. floribundum* are the larger size of the involucre and rays and the increased number of rays (5–8). The isotypes of this species are distinguished by bearing the greatest numbers of disk flowers of any specimens studied and the prevalence of heads with 8 rays and achenes. Otherwise they range well within the cluster for each character tested.

GUATEMALA: SACATEPEQUEZ: Volcán de Agua, S of Santa María de Jesús, 1800–2100 m, 10 Dec 1938, *P. C. Standley 59378* (MICH).

MEXICO: DURANGO: Crest of Sierra Madre Occidental, 2.9 mi E of El Palmito, 2.1 mi E of Sinaloa-Durango state line on México 40, 6700 ft, 31 Jan 1962, *D. E. Breedlove 1744* (MICH).

GUERRERO: Mpio. de Chichihualco, 9 km W of Camotla, elev. 2400 m, 1 Dec 1963, *J. Rzedowski 18019* (MICH); Cerro Tlacatepec, near the sawmill village of Agua Fría, Mpio. de Tlacotepec, ca 40 km N of Coyuca de Benítez, 2650 m, 4 Dec 1963, *C. Feddema 2903* (MICH); approx. same locality, same date, 2500 m, *Rzedowski 18133* (MICH); 16 km E of Agua Fría, elev. 2400 m, 30 Jan 1965, *Rzedowski & McVaugh 273* (MICH); Distr. Montes de Oca, San Antonio, 10 Jun 1937, *G. B. Hinton 10301* (MICH, NY); Distr. Mina, Puerto Rico, 1725 m, 20 Apr 1939, *Hinton 14189* (F, GH, NY, US); Distr. Mina, Chilacayote-Mangito, 1750 m, 30 Nov 1939, *Hinton 14934* (GH, NY, US); Distr. Mina, Petlacala, Barranca del Ranchito, elev. 1905 m, 5 Jan 1938, *Ynes Mexia 9087* (F, GH, NY, US); Sierra Madre [upper Río Tecpan], 1700 m, 26 Jan 1899, *E. Langlassé 795* (GH, MICH, US); W of Omiltemi, 7800 [ft], 9 Jun 1953, *McCorcle & Rowell 3442* (MICH); [Ayahualtempa?], *Sessé, Mociño, et al. 3932* (MA, lectotype of *Eriocephalus trinervatus*).

JALISCO: Nevado de Colima, along a lumber raod which ascends from a point about 11 miles from Atenquique on the Tonila road, 2200 m, 3 Apr 1951, *R. McVaugh 11763* (MICH, US); Nevado de Colima, W of the northern ridge, 2100–2200 m, 16 Oct 1952, *McVaugh 13549* (MICH, US); ca 29 road miles W of Ayutla, mixed forest with fir, elev. ca 1950 m, 3 Nov 1962, *Cronquist 9795* (MICH, NY); Sierra de la Campana, road to Mascota, 7–8 mi NW of Los Volcanes, 1900–2000 m, 23–25 Oct 1952, *McVaugh 13739* (MICH, US); 20–22 km S of Talpa de Allende, elev. 1200–1450 m, 28–30 Mar 1965, *McVaugh 23332* (MICH); near Santa Mónica (probable lat. ca. 20° N., long. ca. 104°30′W.), 1950–2050 m, 12–13 Nov 1952, *McVaugh 14058* (MICH); 12–15 mi SSE of Autlán, 4–10 mi above (SE of) Ahuacapán, 1500–2200 m, 22–23 Nov 1959, *McVaugh & Koelz 981* (MICH); 21–24 km S of El Chante [ca 25 km SE of Autlán], elev. 1650–1850 m, 19 Mar 1965, *McVaugh 23072* (MICH); Sierra del Halo, near a lumber road leaving the Colima highway 7 mi SSW of Tecalitlán, 2000–2200 m, 28–29 Nov 1959, *McVaugh & Koelz 1125* (MICH); San Sebastián, E of Arroyo del Cura, 5 Jan 1927, *Mexia 1395* (GH, US); San Sebastián, Arroyo Seco, 1500 m, 19 Jan 1927, *Mexia 1527* (F,US); W of San Sebastián, Hacienda del Ototal, Arroyo del Ototal, 1500 m, 9 Mar 1927, *Mexia 1852* (A, F, GH, MICH, US, Isotypes of *T. hispidulum*).

MEXICO: Distr. Temascaltepec, Rincón, 1960 m, 19 Nov 1932, *Hinton 2432* (F, GH, NY, US); Distr. Temascaltepec, Tejupilco, 1340 m, 26 Dec 1932, *Hinton 3023* (GH, NY, US); Distr. Sultepec, Almoloya, 28 Mar 1935, *Hinton 7460* (MICH, NY, US); Real de Abajo, Sultepec, 1700 m, 21 Sep 1953, *Matuda 29185* (NY); Distr. Temascaltepec, Cumbre de Tejupilco, 1700 m, 6 Mar 1935, *Hinton 7489* (MICH, NY).

MICHOACAN: Temaxcal, 18 May 1939, *Frye & Frye 2608* (GH, NY, US); Distr. Zitácuaro, Zitácuaro-Jurungeo, 3 Jun 1938, *Hinton 11915* (MICH, NY); Distr. Coalcomán, Coalcomán, elev. 1000 m, 27 Jan 1939, *Hinton 12908* (GH, NY, US); NW of Aguililla, 6–7 km S of Aserradero Dos Aguas, elev. 2000 m, 3 Mar 1965, *McVaugh 22719* (MICH); Morelia, Cerro Azul, 2200 m, *Bro. Arsène 6756* (US); Distr. Zitácuaro, Zitácuaro-Aputzio, 2100 m, 27 Dec 1938, *Hinton 13534* (MICH, NY); Distr. Uruapan, Tancítaro, 2075 m, 11 Oct 1940, *Hinton 15498* (GH, US); between the Río del Salto and La Polvilla, ca. 18 mi E of Morelia, 2160–2400 m, 9–18 Nov 1961, *King & Soderstrom 5030* (MICH, NY); 2 mi S of Tancítaro, 1950 m, 14 Aug 1940, *W. C. Leavenworth 549* (F, GH, NY); Cerro Tancítaro, 2700 m, 19 Aug 1940, *Leavenworth 695* (F).

MORELOS: Sierra de Tepoxtlán, 7500 ft., 27 Nov 1902, *C. G. Pringle 8686* (F, GH, MICH, P, US) [paratypes of *T. floribundum*]; Sierra de Tepoxtlán, near Cuernavaca, 7500 ft., 4 Nov 1900, *Pringle 9179* (GH,[1] lectotype of *T. floribundum*; MICH, US, isolectotypes); Tepoztlán, elev. 1800 m, 30 Dec 1951, *E. Matuda 25898* (NY).

NAYARIT: 9.5 mi W of Tepic, elev. 1000–1100 m, 25 Sep 1960, *McVaugh 19381* (MICH).

OAXACA: Without locality, *Andrieux 243* (P), *Franco* in 1842 (P); cordillera, 4000 ft, Jun 1840, *Galeotti 2130* (P); near Soledad, 6 Feb 1945, *E. J. Alexander 554* (MICH); Sta. Inés del Monte, Zimatlán, 2800 m, 8–9 Dec 1905, *C. Conzatti 1335* (GH); Distr. de Teotitlán, Alturas San Bernardino, 2300 m, 10 Dec 1907, *Conzatti 2088* (F, GH); 10 mi S of Sola de Vega, elev. 2100 m, 8 May 1965, *D. E. Breedlove 9874* (MICH); Distr. del Centro, Acueducto de Xochimilco, 1570 m, 16 Mar 1937, *Conzatti 5257* (MICH, NY, US); on the way to Ixtlán de Juárez, 8–10 mi from Oaxaca, 31 Jan 1960, *King 2495* (MICH); in monte San Felipe, *Andrieux 320* (G, type; P, isotype of *T. melampodioides*); west slope of Mt. Zempoaltepec, 7700–8000 ft, 5–13 Jul 1894, *E. W.*

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[1]The lectotype, at GH, and the sheet at US, have the number written in ink by Pringle as 9178, but corrected to 9179; the MICH sheet bears a printed label with the number 9179. Pringle's no. 9178 was a species of *Gnaphalium.*

Nelson 617 (GH, US, paratypes of *T. tomentosum*); from Panixtlahuaca to Juquila, 1000 ft, 26 Feb 1895, *Nelson 2393* (GH, lectotype of *T. tomentosum*; US, isolectotype); Barranca de San Luis, Cerro San Felipe, 1750 m, 27 May 1906, *Pringle & Conzatti 1438* (GH).

SINALOA: Mazatlán [ex Standley], Jan 1923, *J. G. Ortega 5093* (US).

STATE UNKNOWN: [SINALOA or DURANGO, probably between Mazatlán and Durango], N. W. Mexico, *Seemann* (GH), *Seemann 1893* (P); [possibly GUERRERO], *Sessé, Mociño, et al. 3980, 3990* (F, MA).

THE OAKS (*QUERCUS*) DESCRIBED BY NEE (1801), AND BY HUMBOLDT & BONPLAND (1809), WITH COMMENTS ON RELATED SPECIES[1]

by

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The American oaks were revised in 1924 by William Trelease, who recognized a total of 371 species in addition to numerous named varieties and forms. Since 1924 many additional species have been described, mostly by Trelease himself or with Muller, by Muller alone, or by E. F. Warburg.[1] In our opinion the number of species described is much larger than the actual number, which we suppose cannot exceed 250. The greatest concentration of oaks in America is in central and southern Mexico, where there are perhaps 100–125 species.

Because relatively few specimens of oaks are collected with flowers or fruits, descriptions in the literature (including those of supposedly new species), have often been based primarily on sterile specimens consisting of small leafy twigs. This has compounded the problem for the general taxonomist, because oaks with few exceptions are highly variable in leaf-form. In some species entire, sinuate, sharply serrate and lobed leaves may be found on different parts of the same plant, or the leaves may vary from one plant to another according to the exposure of a particular twig or the rate at which it is growing. Leaf-form in itself is not a good criterion of differences between species, but must be interpreted in the light of correlated characters of pubescence, venation, epidermis, petiole, and, of course, flowers and fruit if these are known. Few Mexican species are adequately known in flowering or fruiting condition; most descriptions of flowers, acorns and cups have been based on woefully inadequate samples. Collectors often take acorns and cups from beneath a tree, assuming that they have come from that particular plant when, in fact, they have sometimes come from a plant of another species.

From the standpoint of nomenclature, also, the Mexican oaks have been a source of frustration to botanists. Paradoxically enough, this is partly because many of the common species were studied and described very early in the history of Mexican botany. Later authors, even up into the present century, have on numerous occasions described the same species under different names, either because they have been unable to consult the types of the earlier authors, or because they have been misled by differences in geographical range or minor variations in leaf-morphology. For these and other reasons a large synonymy has grown up, and we think it desirable to publish a series of observations dealing primarily with the identities of the approximately 36 species described in the two earliest treatments of Mexican oaks, namely those of Née and Bonpland, in 1801 and 1809, respectively.

Luis Née, a naturalized Spaniard of French birth, spent 5 years as a member of the Malaspina Expedition, during which time he travelled and botanized in southern and western South America, Mexico, and also in the Philippines and elsewhere in the southwest Pacific.[2] He was in Mexico from April to December, 1791, crossing the mountains between Acapulco and Mexico City, then visiting the mining districts of Hidalgo and Guanajuato. With a party in charge of Antonio Pineda (the chief naturalist of the expedition), Née left Acapulco on 8 May 1791, and reached Chilpancingo on the 13th. After a side-trip to Tixtla and the caves of Omiapa, they continued through

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[1]Plantae Hintonianae: X. The genus *Quercus*. Kew Bull. 1939: 84–95. 1939.

[2]Apparently little has been published about the life of Née, even including his connection with the Malaspina Expedition. Lasègue (Mus. Bot. Benj. Deless., p. 451–452. 1845) describes his travels briefly. Colmeiro (Bot. Penín. Hisp.-Lus., p. 183. 1858) describes Née's botanical activities in Spain from 1780 to 1784, implying that the year of his birth must have been about 1760 or before. He returned to Spain in September 1794 with large collections of plants, paintings and manuscripts. He himself published very little except for one paper on oaks; Colmeiro says he was temperamentally better suited to the life of an explorer than to the quiet life of a writer.

Zumpango (21 May) and on to México. The party stayed in México until after the middle of August, when they set out for Pachuca and the mines of Real del Monte. They continued via Ixmiquilpan, Zimapan and Tecozautla to Querétaro, thence to Acámbaro (October 10) and finally to Guanajuato. After a week in that city the party returned to México by way of San Miguel el Grande, Chichimequillas, San Juan del Río (9 November), Tepejí del Río and Tlalnepantla. The naturalists then returned to Acapulco to join the main body of the Malaspina Expedition, by way of Amecameca, Puebla (28 November), San Juan Calmecatitlán, Mistepeque, Acatlán, Chilapa and Petaquillas, reaching the coast early in December, 1791.[1]

Née's article on *Quercus,* entitled *Descripciones de varias especies nuevas de encina* (Quercus *de Linneo*), was published in Anales de Ciencias Naturales (Madrid), volume 3, pp. 260–278 (1801), and was translated into English and reprinted under the title *Description of several new Species of Oak, from the Spanish of don Luis Née,* in the Annals of Botany, volume 2, pp. 98–111 (1806). Née proposed a total of 16 names for as many species, 14 of which he had encountered during his Mexican travels, and 2 of which he knew from Californian material received from other Spanish explorers. His descriptions were good (extraordinarily good, for his time), and one can usually identify his species from the descriptions alone, if the type-locality is taken into consideration. Of the names he proposed, all are now in use except three (*Q. circinata, Q. lutea* and *Q. macrophylla* are treated as synonyms of *Q. magnoliifolia*).

Née's original specimens, including what we take to be the types of all the species he described, are preserved in the herbarium of the Instituto Botánico 'A. J. Cavanilles,' Madrid (MA), where Muller studied them in August, 1950, and again in July, 1958 and May, 1964. It transpired that all Née's species could be satisfactorily typified on the basis of his own specimens, especially in the light of recent collections from near the type-localities. Trelease, in the preparation of his monograph, was unable to consult Née's specimens. He remarked on this as follows:

"A series of excellent and seemingly accurate pencil sketches made from these types about 50 years ago under the direction of Professor Lange for use in Liebmann's illustration of the group has shown much about the specimens, and a partial set of cotypes apparently, labelled as from Pavon, occurs in the Boissier herbarium at Geneva; but some of the Née species are still questionable, and these unfortunately are inadequately represented by types even at Madrid."

Trelease was correct in assuming that the sketches were carefully and accurately done, but in themselves they were not always enough to make clear the identities of the species they represented. Née's specimens included several with juvenile leaves and otherwise atypical leaf-forms, and these are not always identifiable from their outlines nor from the original descriptions. The "Pavon" specimens to which Trelease referred are still to be found in the herbarium of the Conservatoire Botanique at Geneva. It is now known that Pavón sold many thousand specimens to Boissier and other collectors, and that these sets included primarily the South American collections of Ruiz and Pavón, and the collections made by the Botanical Expedition to New Spain, i.e. mostly by the botanists Sessé and Mociño. It is possible that Pavón also sold some of Née's collections, but the evidence seems to be against this. Pavón wrote to Philip Barker Webb, for example, in 1826, that he could not send him duplicates of Née's plants, for they were securely in control of the Jardín Botánico.[2] The labels on the specimens at Geneva are inconclusive, but at least one bears an original label with the words "Ex Tixtla" in what seems to be the handwriting of Sessé.[3] A field-party of the Royal

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[1]Most of the above is derived from *Scientific aspects of Spanish exploration in New Spain during the late eighteenth century,* by Iris Higbie Wilson (Ph.D. dissertation, Univ. of Southern California, pp. ix, 330. 1962).

[2]Quoted by Arthur Robert Steele, *Flowers for the King,* p. 314. Duke University Press, 1964.

[3]For a copy of this label we are indebted to Dr. C. E. B. Bonner.

Botanical Expedition to New Spain, including the Director, Martín de Sessé, was in Tixtla and other nearby localities in Guerrero, during the summer of 1789, and could easily have collected this particular specimen. Specimens of *Quercus* labelled by Pavón with the letters "N.E." [for "Nueva España"] are to be found not only in Geneva but also in Florence and perhaps in other European herbaria, and we suppose that most of them represent collections made by Sessé & Mociño, not by Née. In any event they are to be interpreted with caution.

Alexander von Humboldt (1769–1859) and Aimé Bonpland (1773–1858) travelled in Mexico in 1803.[1] Like Née, they passed over the road from Acapulco to Mexico (March 27–April 11); they visited the mines around Pachuca and Actopan (May–June); in August and September they went to Guanajuato from México by way of Tula, Querétaro, and Salamanca; returning from Guanajuato they came by way of Valladolid (now Morelia) and the Volcán de Jorullo (19 September), then back to Morelia and to México by way of Acámbaro, Maravatio, Ixtlahuaca and Toluca. They worked in and near Mexico City until 20 January 1804, when they began their descent to Veracruz via Puebla and Jalapa. On their return to Europe they began publication of the botanical results of Humboldt's "Voyage" with the two sumptuous folio volumes called *Plantes Equinoxiales* (or in the more familiar Latin form, *Plantae Aequinoctiales*). The part dealing with the oaks was written by Bonpland, and published in 1809. It included treatments of 20 species regarded as new, and one species (*Q. acutifolia*) already known to the authors from Née's description. Bonpland's descriptions, written formally in Latin and repeated in French, are accurate and detailed, and each new species is illustrated. Of the 20 new species, about half are currently regarded as valid taxa; the rest of the names are generally treated as synonyms.[2]

Although this has not been much known, there were two issues of *Plantae Aequinoctiales,* with different pagination. Stafleu (Taxonomic Literature, p. 224. 1967) refers to one of format "grand jésus," the other "grand colombier." In the literature on *Quercus,* most authors have cited pages 24–58. In the Library of the U.S. Department of Agriculture, however, is a copy in which the treatment of *Quercus* runs from page 21 to page 50. Page-numbers corresponding to the descriptions of individual species are 3–7 units smaller than those customarily cited. Thus in the Oaks of Texas (Contr. Texas Res. Found. 1, pt. 3: 63. 1951), *Quercus reticulata* Humb. & Bonpl. is cited as having been published on page 35, whereas Trelease and other authors cite it as from page 40. Apparently the smaller edition is rare in libraries; since the matter came to our attention early in 1969 we have not found another copy either in America or in Europe. In our text below we give the page numbers as found in the large edition, citing the other numbers in brackets immediately following.

In the original printing of the larger edition an error occurred. Page 49 began with the fourth line of the Latin description of *Quercus crassifolia,* the initial part of the treatment of this species and the latter part of the text of *Q. stipularis* having been omitted. A corrected leaf was issued, in which the missing text was supplied, and the complete text made to fit into pages 49 and 50. Copies are known with and without the corrected page, and with both corrected and uncorrected pages.

Recognition of the holotypes of species proposed by Humboldt and Bonpland is not always easy. The problem is complicated in several ways. The specimens of Humboldt and Bonpland, as is well known, occur in two principal series. A small but comprehensive series is to be found in the Willdenow Herbarium at the Botanisches Museum, Berlin-Dahlem (B). This set was given by Humboldt to Willdenow before the

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[1] cf. *Humboldt, Bonpland, Kunth and tropical American botany,* edited by William T. Stearn. 159 pp., map. J. Cramer, Lehre, 1968.

[2] Alexandri de Humboldt et Amati Bonpland Plantae Aequinoctiales . . . in ordinem digessit Amatus Bonpland. Vol. 2, pp. 24–58. *pl. 75–96.* 1809–?1810.

latter's death in 1812. The much larger series, that originally retained by Humboldt, is housed in the Muséum National d'Histoire Naturelle, Paris (P). The types of most species described in *Plantae Aequinoctiales,* and in the *Nova Genera et Species* of Humboldt, Bonpland, and Kunth, are to be sought in Paris. An arbitrarily selected series of specimens has been segregated in Paris as the Humboldt Herbarium, and it has often been assumed that all the types are included in this. We do not find this to be true with respect to *Quercus.* Because of Bonpland's special interest in *Quercus*, he made elaborate notes and sketches pertaining to most species. The specimens (seldom more than one to a species) bearing these notes and sketches are sometimes found in the Humboldt Herbarium, but some are also found among the residual duplicates in the general herbarium at Paris. We take these annotated specimens to be the holotypes wherever they may be located, as they were certainly used by Bonpland in the preparation of descriptions and illustrations for the *Plantae Aequinoctiales.* The types of *Quercus mexicana* and *Q. crassipes,* two names reversed in application by Trelease, were identified by means of Bonpland's annotations in the herbarium.

Trelease examined the oaks of Humboldt and Bonpland, both in Berlin and in Paris. Some of his photographic plates are based on specimens in Berlin, and some on those in Paris. He did not ordinarily give formal preference to one institution or the other in designating types, merely attributing the collections to Bonpland and citing them by number. Muller studied the collections at Paris in June 1958, and those in Berlin in August of the same year.

After the work of Humboldt and Bonpland, significant additions to knowledge of the oak-flora of Mexico and Central America were made by Schlechtendal and Chamisso (1830–32), Bentham (1840–1842), Martens & Galeotti (1843) and Liebmann (1854). In this paper we have not attempted to place all the species described by these authors, merely citing the ones that in our opinion are synonyms of species described by Née or by Humboldt & Bonpland. Muller has studied types (or in some instances isotypes) of most of the names proposed by the above authors, especially at Copenhagen (August, 1950, including most of the types of Liebmann), Brussels (August 1958, including most of the types of Galeotti), and Kew (August 1958, including the types of Bentham).

In forming our opinions as stated below, we have studied the types and other collections listed above, and much additional material, including most of the types of Trelease, in the major European and American herbaria. Muller's private herbarium includes approximately 8,000 specimens of *Quercus.* We have about 2,500 collections of oaks obtained by one or the other of us in the course of field-exploration in Mexico, and these have been particularly important in helping us make our decisions.

The species treated in the present paper are arranged alphabetically for the most part. The system employed by Trelease, that of grouping the species into small named taxa called "series," appears to have merit as an aid to study of the American oaks as a whole, but the number and circumscription of the series remains doubtful, and we usually have not attempted to make formal assignments of individual species to these supra-specific taxa.

Quercus acutifolia Née, An. Ci. Nat. 3: 267. 1801; Trel. Mem. Nat. Acad. Sci. 20: 192. *pl. 390,* upper figure. 1924.

Represented in Née's herbarium by four sheets (nos. 25953, 25954, 25955, 152482). Trelease's plate represents a rather typical leaf, from one of these sheets, with 5–6 strong lobe-like teeth on each side. This is a common leaf-form in Guerrero, the type-region, where both *Q. acutifolia* and the sometimes similar *Q. conspersa* Benth. occur. Alphonse DeCandolle (in DC. Prodr. 16, pt. 2: 66. 1864) treated *Q. conspersa* as a variety of *Q. acutifolia,* but the two are best regarded as distinct species. Either may have ovate-lanceolate, long-attenuate and conspicuously glandular leaves broadly rounded at base (as in the type of *Q. acutifolia*), but the acorn-cups in *Q.*

conspersa have inrolled margins, and the leaves tend to be more nearly ovate, somewhat rounded toward the acute or acuminate tip, and of noticeably firm texture.

One of the largest series of American oaks, as treated by Trelease, was the *Acutifoliae.* The taxonomy of the group remains to be completely worked out, but the actual number of species included in it appears to be 15 or more. *Quercus xalapensis* Humb. & Bonpl. Pl. Aequin. 2: 24 [21]. *pl. 75.* 1809, a plant of the Atlantic slope of Veracruz, is hardly different from *Q. acutifolia.* Trelease (pp. 192, 229; *pl. 392,* lower figure) designated as type [i.e. lectotype] *Humboldt* (or *Bonpland*) *4467* in the Willdenow Herbarium. This specimen agrees well with what we take to be the actual type, a sheet in the Bonpland collection (i.e. the general herbarium) at Paris.

The following species is evidently closely related to *Q. acutifolia,* but has much larger leaves than those usual in that species, and more copious pubescence. It is contrasted below with *Q. acutifolia* and *Q. conspersa,* the two species with which it is most likely to be confused in western Mexico:

1. Branchlets and petioles densely and persistently yellow-tomentose; leaves (3.5–) 6–10 cm wide, eglandular at maturity, acute or attenuate at the narrow aristate tip, with 10–14 teeth on each side; acorn cup 20–22 mm wide, with erect margins. *Q. uxoris.*
1. Branchlets and petioles at most thinly tomentose, usually soon glabrescent; leaves commonly 3–5 (–10) cm wide, with few or many teeth, often glandular beneath; cup various, 13–18 (–22) mm wide.
   2. Teeth 6–10 (–15) on each side of the leaf; margins of the cup not inrolled. *Q. acutifolia.*
   2. Teeth 1–6 on each side of the leaf; margins of the cup much inrolled. *Q. conspersa.*

Quercus uxoris McVaugh, sp. nov., arbor grandis usque ad 25-metralis, 1 m diametro, ramulis 2–4 mm crassis, initio pilis crassiusculis aureis vel fulvis tomentosis, tomento subpersistente, cortice castaneo vel fusco, lenticellis prominulis; gemmae 2–4 mm longae, ovoideae, breviacutae, subglabrae, squamulis interioribus ciliatis; stipulae 10–15 mm longae, lineares vel superiores subfiliformes, scariosae, membranaceae, pilosae, deciduae pro parte maxima ante foliorum maturitatem; folia decidua, maturitate coriacea, demum flavescentia, juvenilia minute glanduloso-granularia et stellato-pubescentia, subtus pilis majoribus erectis, aureis, ca 0.5 mm latis, dense objecta, supra sparse stellata et pilis longis simplicibus dispersis munita; venae majores pilosae, pilis conspersis rectis simplicibus usque ad 1–1.5 mm longis; folia ovata vel obovata usque ad elliptica, (10–) 15–26 cm longa, (3.5–) 6–10 cm lata, plerumque 2.5–3-plo longiora quam latiora, apice angusto aristato acuminata vel attenuata, basi latiuscule rotundata (e.g. foliis ovatis), vel ad basin subacutam angustata (e.g. foliis obovatis in eadem planta); margines utroque latere dentibus 10–14 ascendentibus longiaristatis instructi, inter dentes incrassati et revoluti, ad basin integri; dentes asymmetrici, anguste triangulares, usque ad 1–2 cm alti (aristis 5–10 mm longis inclusis), sinubus profundis curvatis separati (vel dentes breviores, obtusi, marginibus tum aristatis sed inter aristas vix incurvatis); venae laterales utroque latere tot quot dentes, in aristas plerumque terminantes; folii superficies matura dura, nitida, atroviridis, quasi glabra (costae basi excepta), venis majoribus pallidis, convexis sed subimpressis, venulis tenuibus pallidis subelevatis; folii pagina inferioris flavida, stellato-pilosa, epidermide pallide viridi, lucida, papillosa, aliter laevi, venis pallidis, arcte elevatis, venulis convexis, quam venulis superficies conspicuioribus; petioli (8–) 12–30 mm longi, 2–3 mm crassi (tomento subpersistente incluso); amenta staminata 6–12 cm longa, pilosa (pilis pro parte maxima simplicibus), laxe florifera, perianthio late campanulato, 1.5 mm alto, ejus lobis obtusis, longiciliatis, antheris glabris, apiculatis, 1.3 mm longis; flores pistillati juveniles pilosi, geminati, sessiles; cupula (exemplo *Rzedowski 14551*) planiuscula, 20–22 mm lata, ca 8 mm alta, squamis canescentibus, basi parum incrassatis, apicibus erectis, adpressis, late obtuseque triangularibus; glans breve ovoidea, basi truncata, 18–19 mm longa, 16–17 mm lata, cupulam multo superans.

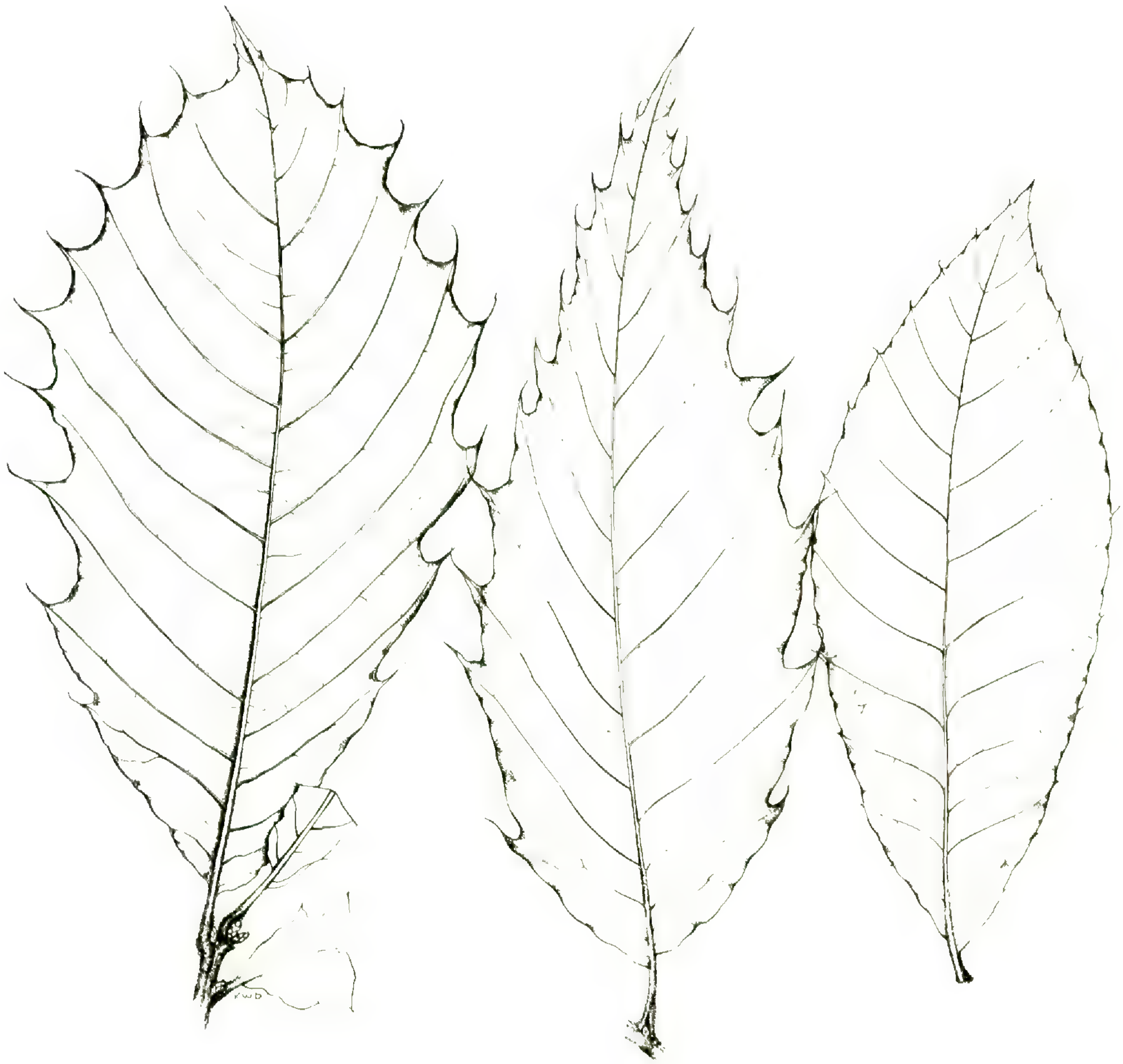

FIG. 64. *Quercus uxoris,* about half natural size. Leaf at right from *Rzedowski & McVaugh 47* (Guerrero), the other figures from the type. Drawn by Karin Douthit.

Species auctoris junioris uxori carissimae Ruth Beall McVaugh, comiti et multorum itinerum mexicanorum socio, dicavimus.

Mexico: on the Pacific Slope of southern Jalisco and Colima, and in the Sierra Madre del Sur of Guerrero, occurring in steep barrancas and on humid wooded hillsides, with pines and other oaks, or with oaks and species of *Prunus, Fraxinus, Magnolia, Carpinus,* and sometimes *Podocarpus,* at elevations of 1200–1700 m.

JALISCO: Above La Cuesta, below the pass to Talpa de Allende, 1200–1500 m, abundant, 16 Oct 1960, *McVaugh 20292* (MICH, type, and isotype; herb. CHM), 22 Nov 1960, *McVaugh 21300* (MICH, herb. CHM); 15–18 km south of Talpa, headwaters of Río de Talpa, *McVaugh 21446* (MICH), *Rzedowski 15067* (ENCB, MICH); above Ahuacapán, 20 km southeast of Autlán, *Rzedowski 14548, 14551* (both ENCB); south-facing foothills 40 km southeast of Autlán, between El Chante and Cuzalapa, *McVaugh 23249* (MICH). COLIMA: Monte de San Antonio, *M. de la Luz Nápoles* (ENCB 772). GUERRERO: 14 km SSW of El Gallo, road to Atoyac, on the southwestern spurs of Cerro Teotepec, approx. 17° 25′ N., 100° 14′ W., *Rzedowski & McVaugh 47* (ENCB, MICH).

Q. agrifolia Née, An. Ci. Nat. 3: 271. 1801; Trel. Mem. Nat. Acad. Sci. 20: 206. *pl. 420.* 1924.

There seems no reason to doubt the application of the name of this well known Californian species. The specimen in Née's herbarium is no. 25959.

Q. ambigua Humb. & Bonpl. See *Q. diversifolia.*

Q. candicans Née, An. Ci. Nat. 3: 277. 1801. *Q. calophylla* Schlecht. & Cham. Linnaea 5: 79. 1830. *Q. alamo* Benth. Pl. Hartw. 55. 1840. *Q. flavida* Liebm. Overs. Dansk. Vidensk. Selsk. Forhandl. 1854: 178. 1854. *Q. acuminata* Mart. & Gal. Bull. Acad. Brux. 10, pt. 1: 217. 1843. *Q. umbrosa* Endl. Gen. Suppl. 4, pt. 2: 26. 1847. *Q. intermedia* Mart. & Gal. Bull. Acad. Brux. 10, pt. 1: 223. 1843.

The type consists of six detached juvenile leaves, obviously the species called *Q. candicans* by Trelease. There seems to be no real distinction between *Q. candicans* and *Q. calophylla* (including the other synonyms listed above, all of which were assigned to *calophylla* by Trelease). See also U.S.D.A. Misc. Publ. 477: 81. 1942, where this synonymy is confirmed.

Q. castanea Née, An. Ci. Nat. 3: 276. 1801; Trel. Mem. Nat. Acad. Sci. 20: 178. *pl. 358,* upper fig. 1924. *Q. pulchella* Humb. & Bonpl. Pl. Aequin. 2: 44 [38]. *pl. 88.* 1809. *Q. lanigera* Mart. & Gal. Bull. Acad. Brux. 10, pt. 1: 215. 1843. *Q. tristis* Liebm. Overs. Dansk. Vidensk. Selsk. Forhandl. 1854: 174. 1854. Additional synonyms are *Q. axillaris* Trel., *Q. subcrispata* Trel., *Q. circummontana* Trel., *Q. serrulata* Trel., ?*Q. alamosensis* Trel., *Q. rossii* Trel., *Q. tepoxuchilensis* Trel., *Q. impressa* Trel., *Q. seleri* Trel., *Q. verrucosirama* Trel., *Q. spathulistipula* Trel., *Q. crassivenosa* Trel.

Née's specimens of *Q. castanea* are exactly as described by Trelease, most of the leaves having acute apices. Our concept of *Q. castanea* includes most of what Trelease called Ser. *Castaneae.*

Q. chrysophylla Humb. & Bonpl. See *Q. laurina.*

Q. circinata Née. See *Q. magnoliifolia.*

Q. confertifolia Humb. & Bonpl. See *Q. crassipes.*

Q. crassifolia Humb. & Bonpl. Pl. Aequin. 2: 49 [43]. *pl. 91.* 1809; Trel. Mem. Nat. Acad. Sci. 20: 128. *pl. 234,* upper fig. 1924. *Q. stipularis* Humb. & Bonpl. Pl. Aequin. 2: 47 [41]. *pl. 90.* 1809. *Q. brachystachys* Benth. Pl. Hartw. 91. 1842. Additional synonyms are *Q. felipensis* Trel., *Q. moreliana* Trel., *Q. errans* Trel., *Q. chicamolensis* Trel., *Q. orbiculata* Trel., *Q. miguelitensis* Trel.

The type (*s.n.*, in herb. Humboldt, 3 sheets from Chilpancingo), seems to represent the species treated under this name by Trelease. The type of *Q. stipularis* (*s.n.*, in herb. Humboldt, represented by Trelease's plate 242) is the same species. Another sheet labelled *Q. stipularis* (Actopan, in herb. Humboldt, *s.n.*, with manuscript notes by Bonpland) is a juvenile specimen of *Q. crassifolia.* The type of *Q. brachystachys* (*Hartweg 618,* seen at K and BM) is conspecific with the above.

Q. crassipes Humb. & Bonpl. Pl. Aequin. 2: 37 [32]. *pl. 83.* 1809. *Q. mexicana* sensu Trelease, not of Humb. & Bonpl. *Q. crassipes* var. *angustifolia* Humb. & Bonpl. Pl. Aequin. 2: 38 [33]. *pl. 84.* 1809. *Q. confertifolia* Humb. & Bonpl. Pl. Aequin. 2: 53 [47]. *pl. 94.* 1809. Additional synonyms are *Q. colimae* Trel., *Q. imbricariaefolia* Trel., *Q. obovalifolia* Trel., *Q. malifolia* Trel.

The type of *Q. crassipes* (in herb. Humboldt., *s.n.,* with manuscript description by Bonpland), and that of *Q. crassipes* var. *angustifolia* (in herb. Humboldt, *s.n.,*), are both specimens of the plant with narrow leaves bullate beneath, treated by Trelease as *Q. mexicana.* The type of *Q. confertifolia* (*Bonpland 4407*, with manuscript description, in Herb. Gen., Paris), is very like the specimens of *Q. crassipes* but only sparingly pubescent.

Q. depressa Humb. & Bonpl. Pl. Aequin. 2: 50 [44]. *pl. 92.* 1809. *Q. subavenia* Trel. Mem. Nat. Acad. Sci. 20: 169. *pl. 338,* upper figure. 1924, is a synonym. An isotype of *Q. subavenia (Pringle 8908),* at Paris, has been compared with the type of *Q. depressa (Bonpland 4145* in the general herbarium, at Paris). A specimen *(Humboldt, s.n.)* in the Willdenow herbarium (no. 17621) is evidently a duplicate of the type of *Q. depressa;* it is represented by Trelease's plate 338, lower figure. (The photographs in Trelease's plate 338 were reversed in publication; the top figure, as indicated by comparison with the specimens photographed, represents Pringle's collection of *Q. subavenia,* whereas the lower figure is taken from the isotype of *Q. depressa* in the Willdenow herbarium).

Q. diversifolia Née, An. Ci. Nat. 3: 270. 1801. *?Q. ambigua* Humb. & Bonpl. Pl. Aequin. 2: 51 [45]. *pl. 93.* 1809, not *Q. ambigua* Michx. f., 1801. *?Q. bonplandiana* Sweet, Hort. Brit. 370. 1826. *?Q. laeta* Liebm. Overs. Dansk. Vidensk. Selsk. Forhandl. 1854: 179. 1854.

Née's concept of this species may have been derived from more than one source, as he gave the locality as "junto a Chalma y Santa Rosa." These localities are some distance apart, and in somewhat different floristic areas, and it is at least possible that his description of the leaves as "integris aut dentatis" refers to two different species. The plant in his herbarium, however (sheet no. 26468, at Madrid), seems to belong to the alliance of small-leaved white oaks including *Q. laeta, Q. pallescens* Trel., *Q. bipedalis* Trel., *Q. obscura* Trel., and *Q. transmontana* Trel. These are plants with narrowly elliptic to oblong or oblanceolate leaves commonly 2–3 cm wide and 5–9 cm long, sparsely pubescent but essentially eglandular beneath, and peduncles 2–5 (–10) cm long. Superficially some individuals may resemble *Q. obtusata,* but in that species the lower leaf-surface is normally copiously glandular, the leaves 7–15 cm long, and the peduncles longer than in *Q. laeta.*

In Née's specimens the leaves are 3–7 cm long, 1.5–3 cm wide, oblong, obtuse or rounded at base, obtuse at apex, subentire or more commonly coarsely toothed above the middle, glossy and markedly impressed-veiny above, the lower surface yellowish-wooly, the hairs longer, and longer-stalked, than usual in *Q. laeta.* The peduncles are 5–7 cm long.

In the type of *Q. ambigua* (*Bonpland s.n.,* in hb. Humboldt, illustrated in Trelease's pl. 103) the leaves are a little larger than those described for *Q. diversifolia* (3–5 cm wide, 8–10 cm long). In aspect they suggest those of *Q. obtusata,* but the pubescence appears to be that of *Q. laeta* (syntypes *Hartweg 419!* and *Seemann 1971!,* the latter also the type of *Q. obscura*).

To summarize, the plant known as *Q. laeta* Liebm., and lectotypified by *Hartweg 419,* may well be the same as *Q. ambigua* (*Q. bonplandiana* Sweet), but in the latter the leaves are unusually large for *Q. laeta.* An even older name, perhaps for the same taxon, is *Q. diversifolia,* but the foliar pubescence in the type of the latter is somewhat different from that of *Q. laeta.* For the present we prefer to use the more familiar name *laeta* for a rather widely distributed and much-collected species, noting the possibility that when the types of the older names are better understood, *laeta* may have to be abandoned.

If Née's type is not accepted as a basis for supplanting *Q. laeta,* the alternative seems to be to assign it to a taxon that includes *Q. centralis* Trel. Mem. Nat. Acad. Sci. 20: 61. *pl. 60.* 1924, and also *Q. chartacea* Trel. (l.c.) and *Q. sanchez-colini* Martínez, and to take up the name *Q. diversifolia* for this plant of eastern and south-central Mexico.

Q. elliptica Née, An. Ci. Nat. 3: 278. 1801. *Q. pubinervis* Mart. & Gal. Bull. Acad. Brux. 10, pt. 1: 211. 1843. *Q. nectandraefolia* Liebm. Overs. Dansk. Vidensk. Selsk. Forhandl. 1854: 175. 1854. *Q. oajacana* Liebm. Overs. Dansk. Vidensk. Selsk.

Forhandl. 1854: 178. 1854. *Q. linguaefolia* Liebm. Overs. Dansk. Vidensk. Selsk. Forhandl. 1854: 180. 1854. Additional synonyms are *Q. langlassei* Trel., *Q. chiquihuitillonis* Trel., *Q. exaristata* Trel., *Q. hondurensis* Trel., *Q. botryocarpa* Trel., *Q. yoroensis* Trel., *Q. atrescentirhachis* Trel., *Q. coccinata* Trel., *Q. peradifolia* Warb.

Trelease failed to place *Q. elliptica* satisfactorily. The species of his series *Nectandraefoliae* and *Oajacanae* are referable to it. His plate 359, upper figure, is said (p. 228) to be a sketch of the type of *Q. elliptica,* and at the same time an illustration representing *Q. castanea* var. *elliptica* Trel. *Q. elliptica* is a very distinct species recognizable by its thick, tomentose twigs, and obovate or elliptic, entire and rather smooth leaves. It is a black oak not closely related to *Q. castanea.* Née's specimen is quite characteristic.

Q. glaucescens Humb. & Bonpl. Pl. Aequin. 2: 29 [25]. *pl. 78.* 1809. *Q. chinantlensis* Liebm. Overs. Dansk. Vidensk. Selsk. Forhandl. 1854: 179. 1854. *Q. cuneifolia* Liebm. Overs. Dansk. Vidensk. Selsk. Forhandl. 1854: 182. 1854, not *Q. cuneifolia* Raf., 1838. *Q. pinalensis* Trel. Contr. U.S. Nat. Herb. 23: 179. 1922. *Q. synthetica* Trel. Mem. Nat. Acad. Sci. 20: 151. *pl. 297,* upper figure. 1924. Additional synonyms are *Q. obscurirhachis* Trel., *Q. nigrirhachis* Trel., and *Q. texequitzinae* Trel.

Represented at Paris by *Bonpland 3921,* in the General Herbarium. This is a specimen with somewhat immature leaves bearing the characteristic minute stellate hairs beneath. Trelease published a photograph (his plate 50) of another sheet (at Berlin) of no. 3921, and designated this as type. We agree with Trelease's interpretation of the species, but not with his circumscription of it. He regarded *Q. glaucescens* as the type of the monotypic Ser. *Glaucescentes,* he assigned *Q. chinantlensis* and *Q. pinalensis* (*Q. cuneifolia* Liebm.) to Ser. *Excelsae,* and *Q. synthetica* (*Ghiesbreght 121!,* the type, at Copenhagen) to the black oaks.

Quercus austrina Small, Flora S.E. U.S. 353. 1903, appears to be related to *Q. glaucescens,* not to *Q. sinuata* Walt., with which it was erroneously combined by Muller (Contr. Texas Res. Found. 1: 65. 1951). Field-study by Muller, of *Q. austrina* and *Q. glaucescens,* since that writing, has revealed the relationship between them.

Q. lanceolata Humb. & Bonpl. See *Q. laurina.*

Quercus laurina Humb. & Bonpl. Pl. Aequin. 2: 32 [28]. *pl. 80.* 1809. *Q. lanceolata* Humb. & Bonpl. Pl. Aequin. 2: 34 [29]. *pl. 81.* 1809. *Q. chryosphylla* Humb. & Bonpl. Pl. Aequin. 2: 42 [37]. *pl. 87.* 1809. *Q. tridens* Humb. & Bonpl. Pl. Aequin. 2: 56 [50]. *pl. 96.* 1809. *Q. barbinervis* Benth. Pl. Hartw. 56. 1840. *Q. tlapuxahuensis* A. DC. in DC. Prodr. 16, pt. 2: 29. 1864. *Q. nitens* δ *major* A.DC. in DC. Prodr. 16, pt. 2: 69. 1864. *Q. ocoteaefolia* Liebm. Dansk. Vidensk. Selsk. Forhandl. 1854: 176. 1854. Additional synonyms are *Q. major* (A.DC.) Trel., *Q. bourgaei* Trel., *Q. roseovenulosa* Trel., *Q. caeruleocarpa* Trel., *Q. treleaseana* Camus.

Trelease treated the above species of Humboldt & Bonpland as members of two series, the *Lanceolatae* (including *Q. lanceolata* and *Q. laurina*), and the *Tridentes* (including *Q. tridens* and *Q. chrysophylla*). The type of *Q. laurina* (herb. Humb. & Bonpl. 4143) represents the species treated by Trelease under this name. The other three species are represented by Bonpland's specimens in the General Herbarium at Paris, as follows:

Q. lanceolata: "Inter Moran et Santa Rosa," *Bonpland s.n.* Type and two isotypes, all clearly the same as *Q. laurina. Q. tridens: Bonpland 4061,* a type and 2 isotypes; like *Q. chrysophylla, Q. tridens* is merely a juvenile form of *Q. laurina. Q. chrysophylla: Bonpland 4162,* a type and two isotypes, clearly juvenile *laurina* with heavy golden puberulum except on two mature leaves on one sheet.

Q. lobata Née, An. Ci. Nat. 3: 277. 1801; Trel. Mem. Nat. Acad. Sci. 20: 100. *pl. 168.* 1924.

After a brief description in the protologue is the remark by Née, "he visto [solamente] los ramos que de Monterey me traxéron los Sres. Robredo y Esquerra." The specimen in his herbarium (no. 26477), however, is marked "Monte Rey et Nootka." We refer this specimen confidently to the Californian species called *Q. lobata* by Trelease. The application of the name *Q. lobata* Née seems never to have been in doubt. The older name *Q. lobata* Bartram (1791) is a *nomen nudum* (cf. E. D. Merrill, in Bartonia 23: 34. 1945).

Q. lutea Née. See *Q. magnoliifolia.*

Q. macrophylla Née. See *Q. magnoliifolia.*

Q. magnoliifolia ["*magnoliaefolia*"] Née, An. Ci. Nat. 3: 268. 1801. *Q. lutea* Née, An. Ci. Nat. 3: 269. 1801. *Q. circinata* Née, An. Ci. Nat. 3: 272. 1801. *Q. macrophylla* Née, An. Ci. Nat. 3: 274. 1801. *Q. nudinervis* Liebm. Overs. Dansk. Vidensk. Selsk. Forhandl. 1854: 182. 1854. Additional synonyms are *Q. erubescens* Trel., *Q. haematophlebia* Trel., *Q. rubescens* Trel., *Q. tepicana* Trel., *Q. platyphylla* Warb.

The four species described by Née were all from the region between Tixtla and Chilpancingo, Guerrero. His specimens in Madrid indicate that the four names pertain to one and the same species. The type of *Q. magnoliaefolia* (sheet no. 25969) represents the species as understood by Trelease; the twigs show the lenticels described by Née, but the leaves are smaller than usual in the species. The type of *Q. macrophylla* is represented by the drawing reproduced by Trelease as his plate 65, upper figure; this is typical *magnoliifolia,* with twigs quite glabrous (sheet no. 26466). Sheet no. 26472 is to be taken as the type of *Q. circinata,* the description of which it fits in every detail, although it is annotated as "Quercus Prinus Linn. var^{s}. lutea." The leaves are typical of *Q. magnoliifolia,* but the twigs are short-tomentose. All that remains of the type of *Q. lutea* are two detached leaves (sheet 152486), these resembling the material of *Q. circinata.*

Alphonse DeCandolle (1864) treated *Q. lutea* and *Q. macrophylla* as varieties of *Q. magnoliifolia,* and *Q. circinata* as a distinct species. Trelease, however, recognized all four as distinct. He mistakenly associated *Q. macrophylla* with *Q. resinosa* Liebm., in a small series called *Macrophyllae,* and contrasted the other three in another series called *Circinatae.* The plant that (following Trelease's treatment) has become well known as *Q. macrophylla* is properly called *Q. resinosa* Liebm. (Overs. Dansk. Vidensk. Selsk. Forhandl. 1854: 182. 1854).

If Née's four names are treated as pertaining to one species, the epithet *magnoliifolia* must be taken up in preference to *lutea* and *macrophylla,* because this choice was made by DeCandolle. We suggest that *circinata* likewise be treated as a synonym of *magnoliifolia.* The spelling *magnoliifolia* is consistent with Rec. 73G of the International Code of Botanical Nomenclature.

Q. mexicana Humb. & Bonpl. Pl. Aequin. 2: 35 [30]. *pl. 82.* 1809. *Q. rugulosa* Mart. & Gal. Bull. Acad. Brux. 10, pt. 1: 209. 1843. *Q. mexicana* f. *bonplandii* Trel. Mem. Nat. Acad. Sci. 20: 174. 1924. *Q. pablillensis* C.H. Mull. Amer. Midl. Nat. 27: 477. 1942.

The type of *Q. mexicana* (Herb. Humboldt, no. 4060, two sheets, one with manuscript description by Bonpland) is exactly what has been called *Q. rugulosa* by all authors, including Trelease. A third sheet of the same number, taken by Trelease (p. 174) to be the type of *Q. mexicana,* is a mixture of *Q. rugulosa* [i.e. *mexicana*] and *Q. crassipes.* Possibly as a result of the mixing of *Q. crassipes* and the true *Q. mexicana* on some sheets in the Humboldt and Bonpland collection, Trelease described and illustrated both *crassipes* and *mexicana* from specimens of the former. The type of *Q. rugulosa* (*Galeotti 116,* seen at Brussels) is clearly *Q. mexicana,* as is also the type of *Q. pablillensis.*

Q. microphylla Née, An. Ci. Nat. 3: 264. 1801; Trel. Mem. Nat. Acad. Sci. 20: 82. *pl. 119,* upper figure. 1924. *Q. striatula* Trel. Mem. Nat. Acad. Sci. 20: 93. *pl. 151, 152.* 1924.

The type of *Q. microphylla* (MA 26469) is a specimen from Guanajuato. *Q. striatula,* described from Durango and adjacent Nayarit and Zacatecas, seems to be conspecific.

Q. obtusata Humb. & Bonpl. Pl. Aequin. 2: 26 [23]. *pl. 76.* 1809. *Q. pandurata* Humb. & Bonpl. Pl. Aequin. 2: 28 [24]. *pl. 77.* 1809. *Q. spicata* Humb. & Bonpl. Pl. Aequin. 2: 46 [40]. *pl. 89.* 1809. *Q. hartwegi* Benth. Pl. Hartw. 56. 1840. *Q. obtusata β pandurata* (Humb. & Bonpl.) A.DC. in DC. Prodr. 16, pt. 2: 27. 1864. *Q. obtusata γ Hartwegi* (Benth.) A.DC. in DC. Prodr. 16, pt. 2: 27. 1864. *Q. rugosa* sensu Trel. Mem. Nat. Acad. Sci. 20: 75. *pl. 101, 102.* 1924, not *Q. rugosa* Née. Additional synonyms are *Q. panduriformis* Trel., *Q. alvarezensis* Trel., *Q. crenatifolia* Trel., *Q. atriglans* Warb., *Q. warburgii* A. Camus.

The types of *Q. obtusata* and *Q. pandurata* certainly represent the same species, as supposed by Alphonse DeCandolle and by Trelease. *Bonpland 4061,* the type of *Q. spicata,* illustrated by Trelease (his plate 102), seems clearly the same, although he referred it to the synonymy of *Q. rugosa* Née. Traditionally *Q. hartwegii* Benth. has been distinguished from *Q. obtusata* by the somewhat larger size of the acorns, but in large series of specimens from western Mexico we find this feature is not distinctive.

Q. pandurata Humb. & Bonpl. See *Q. obtusata.*

Q. peduncularis Née, An. Ci. Nat. 3: 270. 1801; Trel. Mem. Nat. Acad. Sci. 20: 69. *pl. 83.* 1924. *Q. tomentosa* Willd. Sp. Pl. 4: 437. 1805. *Q. callosa* Benth. Pl. Hartw. 91. 1842. *Q. affinis* Mart. & Gal. Bull. Acad. Brux. 10, pt. 1: 222. 1843, not *Q. affinis* Schweidw. 1837. *Q. tomentosa α communis* A.DC. in DC. Prodr. 16, pt. 2: 33. 1864. *Q. tomentosa γ abbreviata* A.DC. in DC. Prodr. 16, pt. 2: 33. 1864. *Q. martensiana* Trel. Contr. U.S. Nat. Herb. 23: 182. 1922. *Q. pilicaulis* Trel. Mem. Nat. Acad. Sci. 20: 67, as to type. 1924. *Q. barbanthera* Trel. Mem. Nat. Acad. Sci. 20: 68. 1924. *Q. dolichopus* E. F. Warb. Kew Bull. 1939: 87. 1939.

This is a distinctive species, correctly but too narrowly interpreted by Trelease. *Q. martensiana* (= *Q. affinis* Mart. & Gal.) belongs with *Q. peduncularis* rather than among the *Prinopses* where Trelease placed it. The type of *peduncularis* evidently represents the species shown in Trelease's plate 83, and in U.S.D.A. Misc. Publ. 477, *pl. 35, 36.* 1942.

Q. pulchella Humb. & Bonpl. See *Q. castanea.*

Q. repanda Humb. & Bonpl. Pl. Aequin. 2: 31 [27]. *pl. 79.* 1809. *Q. revoluta* Trel. Mem. Nat. Acad. Sci. 20: 78. *pl. 111, 112.* 1924. *Q. lecomteana* Trel. Mem. Nat. Acad. Sci. 20: 81. *pl. 115.* 1924. *Q. subtriloba* Trel. Mem. Nat. Acad. Sci. 20: 81. *pl. 118.* 1924.

The type appears to be no. 4081 in the herbarium of Humboldt & Bonpland; it bears Bonpland's manuscript description. Trelease assigned *Q. repanda* to Ser. *Microphyllae,* and divided the above synonyms between two other series.

Q. reticulata Humb. & Bonpl. See *Q. rugosa.*

Q. rugosa Née, An. Ci. Nat. 3: 275. 1801. *Q. reticulata* Humb. & Bonpl. Pl. Aequin. 2: 40 [35]. *pl. 86.* 1809. *Q. decipiens* Mart. & Gal. Bull. Acad. Brux. 10, pt. 1: 214. 1843. The synonymy also includes most of the species assigned by Trelease to Ser. *Reticulatae,* except *Q. bonplandiana* Sweet (= *Q. ambigua* Humb. & Bonpl.), which is a synonym of *Q. diversifolia* Née, and *Q. alvarezensis* Trel., which is a synonym of *Q. obtusata.* Trelease included *Q. spicata* Humb. & Bonpl. among the

synonyms of *Q. rugosa,* but the type of *Q. spicata (Herb. Humb. & Bonpl. no. 4061)* is clearly the same as *Q. obtusata* Humb. & Bonpl.

Q. salicifolia Née, An. Ci. Nat. 3: 265. 1801; Trel. Mem. Nat. Acad. Sci. 20: 154. *pl. 301,* upper fig. 1924. *Q. tahuasalana* Trel. Mem. Nat. Acad. Sci. 20: 154. *pl. 302,* upper fig. 1924. *?Q. acapulcensis* Trel. Mem. Nat. Acad. Sci. 20: 153. *pl. 302,* lower fig. 1924.

The type of *Q. salicifolia* (MA 25957) is evidently the species treated by Trelease under this name. The type of *Q. tahuasalana* is certainly conspecific; the acorn-differences noted by Trelease are inconsequential. The figures of *Q. tahuasalana* and *Q. acapulcensis* are interchanged in Trelease's plate 302, whereas the legends are correctly placed. The type of *Q. tahuasalana (Langlassé 211),* while correctly cited in the explanation of the plate, is erroneously given as no. 217 in the text. Broad-leaved forms referable to *Q. acapulcensis* are found from Jalisco to Guerrero, as are many forms intermediate between the broad- and narrow-leaved forms. These are closely associated in the field with *Q. salicifolia,* and there appear to be no other significant differences between the latter and *Q. acapulcensis.*

Q. sideroxyla Humb. & Bonpl. Pl. Aequin. 2: 39 [34]. *pl. 85.* 1809. *Q. omissa* A.DC. in DC. Prodr. 16, pt. 2: 28. 1864.

In the herbarium at Paris are three sheets of *Q. sideroxyla.* One sheet (*s.n.,* in herb. Humboldt), from Santa Rosa, was taken by Trelease to be the type, and illustrated by him (p. 169, *pl. 339,* upper figure). The plant is *Q. eduardii* Trel. The remaining sheets of *Q. sideroxyla* (under no. 4219) are in the general herbarium. One sheet (labelled as from Santa Rosa) represents *Q. eduardii.* The other sheet is labelled as from Villalpando (the type-locality), and fits both the illustration and description ("folia . . . subtus exilissimo tomento canescentia"). Evidently this sheet is the actual type. It represents the species later described as *Q. omissa.*

Evidently Humboldt and Bonpland confused under the one name two species, one collected at Santa Rosa ("Nous en avons d'abord trouvé quelques pieds assez beaux dans le voisinage de Santa Rosa") and the other later at Villalpando ("Quelques temps après, allant visiter les mines de Villalpando, nous en trouvâmes un plus grand nombre"). In the formal part of the protologue of *Q. sideroxyla,* the type-locality is given as "in Nova Hispania, prope Villalpando." Trelease selected a specimen of *Q. eduardii* from Santa Rosa as the type, but as noted above, and as shown in his plate 339, this plant is apparently not the one on which Bonpland's description and plate were primarily based.

Q. spicata Humb. & Bonpl. See *Q. obtusata.*

Q. splendens Née, An. Ci. Nat. 3: 275. 1801.

This was long a doubtful species, because Née's description was based entirely on specimens with half-grown leaves, that he collected near Tixtla, Guerrero, in April, 1791. Recent collections from the type locality (*Muller 9169, 9170*) provide immature leaves that match Née's own specimens precisely, and mature leaves and fruits (all attached) by which the species can be identified. It is clear that *Q. splendens* is a white oak closely related to *Q. sororia* Liebm. and *Q. polymorpha* Schlecht. & Cham. Trelease placed *Q. splendens* among the black oaks, on the basis of a sketch of the type (his plate 252, upper figure). At the same time Trelease placed *Q. polymorpha* and *Q. sororia* in two closely associated series of white oaks, *Polymorphae* and *Glaucoideae.* A better course seems to be the inclusion of all three species in the one series, *Polymorphae.*

Q. stipularis Humb. & Bonpl. See *Q. crassifolia.*

Q. tridens Humb. & Bonpl. See *Q. laurina.*

FIG. 65. *Quercus pallidifolia*, about 7/10 natural size. Photograph of the holotype.

Addendum

One of the minor mysteries, among our legacies from the earliest explorers, involves the absence from their collections of some very common species. Thus Née did not include *Quercus mexicana* or *Q. crassipes* among his copious collections, although both species are abundant over much of the area he traversed. Similarly, both Née and Bonpland failed to collect *Q. glaucoides* Mart. & Gal., although this is one of the most common small oaks over much of their areas. One may speculate that the collectors observed these species in the field but failed to make specimens because they misinterpreted what they saw, assuming that the plants represented variants of species they had already collected. Another possibility is that Née, at least, may have collected specimens and considered them in his concepts of such variable species as (e.g.) *Q. diversifolia,* and eventually discarded them in favor of the types which he retained.

Many new species related to *Quercus glaucoides* have been proposed and named since *Q. glaucoides* itself was described in 1843, but most of the novelties are taxa of little or no significance. Only a few highly localized populations, such as *Q. microlepis* Trel. & Muell., and *Q. perpallida* Trel. appear to be really specifically distinct. Another such localized population, of even greater distinctness, is described below:

Quercus pallidifolia C. H. Muller, sp. nov.; arbor usque ad 10-metralis, ramulis 3–5 mm crassis, glabris, pruinosis, russis, lenticellis pallidis prominentibus; ramuli anno tertio vel quarto corticem pallidam mollem squamosam evolventes; gemmae subsphaericae 2–2.5 mm longae et fere aequilatae, glabrae; stipulae 2–3 mm longae, anguste ligulatae, glabrae; folia vix decidua, 10–20 cm longa, 6–14 cm lata, obovata vel late spathulata, apice late rotundata, marginibus obscure undulata, basi plerumque valde angustata, cordato-auriculata, supra impolita vel paullo lucentia, perglabra vel secus costam pruinosam parce puberula; folia subtus impolita, glabra vel minute puberula et pilis stellatis minutis sparsissimis instructa; epidermis microscopice pallideque papillosa, papillis convexis ut videtur ceraceis confertis, inter venulas parenchymatem omnino tegentibus; venae principales utroque latere ca 10–12, supra vix elevatae, subtus reticulumque venularum prominens; petioli 2–5 (–8) mm longi, rufescentes, valde pruinosi; flores fructusque non vidi.

Specimens examined: SINALOA: Mpio. Sinaloa y Vela, above rancho Laureles, 6 miles NW of Los Hornos, along road from Mocorito to Surutato, Sierra Surutato, elev. ca 1600 m, 30 Sep 1970, *D. E. Breedlove & R. F. Thorne 18164* (herb. CHM); Bacayopa, Choix, Nov 1951, *Ramón Castro 2227* (herb. CHM). NAYARIT: Los Jazmines, Santa María del Oro, 20 Sep 1951, Roberto Pérez C. *2135* (herb. CHM, type; MICH, isotype).

The vegetative characters of this species constitute a unique feature, so that without fruit it is difficult to assign to it a close relationship. The epidermal characters are suggestive of *Q. germana* Schl. & Cham., to which *Q. pallidifolia* is basically unrelated, and from which it is readily distinguished by its uniformly obovate leaves. The glabrous twigs and obscurely undulate margins of the obovate leaves are reminiscent of those of *Q. magnoliifolia* Née, which lacks the epidermal peculiarities of *Q. pallidifolia* and is otherwise unrelated to it. The epidermal characters of *Q. pallidifolia* are more or less suggested in *Q. glaucoides* Mart. & Gal., in which large obovate leaves are not known. The relationship of *Q. pallidifolia* is perhaps closest to *Q. glaucoides.*

PRELIMINARY STUDIES ON THE DOTHIDEALES IN TEMPERATE NORTH AMERICA

by

MARGARET E. BARR[1]

University of Massachusetts

CONTRIBUTIONS FROM THE UNIVERSITY OF MICHIGAN HERBARIUM
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University Herbarium, University of Michigan
Ann Arbor, Michigan
1972

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[1]Mrs. H. E. Bigelow, Department of Botany, University of Massachusetts, Amherst, Mass. 01002.

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Introduction

Scope of the study

In the field of mycology at the present time, many of the fungi which are most frustrating to attempt to classify are the Ascomycetes of pyrenomycetous nature. While it is possible to identify many species from descriptions in the literature, the position of these species in respect to one another is difficult to assign. A major step toward a modern classification was provided by Luttrell (1951b, 1955), where he expanded Miller's (1928) and Nannfeldt's (1932) recognition of differences between the subclasses Loculoascomycetes and Euascomycetes and utilized the basic characteristics of the ascus and of centrum development to delimit major groups. Currently, studies of generic types by a number of investigators are providing a firm base for the assignment of taxa to the correct genus. Several systems of classification are available, but none of these is entirely satisfactory. The following synopsis is offered as an alternative arrangement of one order in the Loculoascomycetes. For the present, the system applies to fungi known from temperate North America. The classification probably will have to be expanded and emended as tropical and temperate fungi from other continents are studied. My intention is to continue with similar studies of taxa in the other orders of both Loculoascomycetes and Euascomycetes.

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To the late Dr. L. E. Wehmeyer I am indebted for many suggestions and discussions on the problems of ascomycete systematics. Nomenclatural problems have been discussed with Mr. H. E. Ahles, University of Massachusetts. I would especially thank my husband, Dr. H. E. Bigelow, for his encouragement, patience, and assistance throughout this study. The contributions of my predecessors and colleagues to the systematics of ascomycetes are acknowledged in the body of the paper.

Explanations and Abbreviations

Herbarium designations included in the citations of specimens are the standard designations listed in Lanjouw and Stafleu (1964). Citations of specimens, where possible, are by the collector's name and number. The states or provinces from which

collections have been examined are arranged in sequence from north to south and east to west.

In the interest of conserving space species diagnoses are given whereas full generic descriptions are provided throughout the study. Thus, for details of individual species, both the specific and generic descriptions should be utilized. No claim is made that all species of the region are included; representative species illustrate some of the variations which occur.

The orders of subclass Loculoascomycetes

The Loculoascomycetes embody three major types of development of the ascocarp and the bitunicate ascus (Luttrell 1951b). Each type results in mature ascocarps which can be characterized to aid in classification of the fungi involved. Three orders are recognized here:

Myriangiales: *Elsinoe* developmental type. Ascocarps often irregular in shape, opening irregularly, wall not differentiated. Asci developing singly at various heights or forming a layer, within monascous cavities separated by interthecial tissues.

Dothideales: *Dothidea* developmental type (*Pseudosphaeria* developmental type intermediate between *Elsinoe* and *Dothidea* developmental types.) Ascocarps pulvinate, perithecium-like, hemispherical, or compound, opening irregularly or by defined pore region, the wall varying from undifferentiated to somewhat differentiated. Asci developing in a layer in monascous cavities separated by interthecial tissues, or obliterating the locule tissue and forming a broad layer or a compact fascicle.

Pleosporales: *Pleospora* developmental type. Ascocarps perithecium-like, pulvinate, elongate, hemispherical, or compound, opening irregularly or by a defined pore region or by a slit, the wall usually somewhat differentiated. Asci developing in a layer among pseudoparaphyses which occupy the locule early in development and at maturity may be obvious or indistinct.

Characteristics and their possible evolutionary sequence

Within the Loculoascomycetes, variation in certain characteristics appears to indicate a primitive or a more advanced state of evolution. Ascocarps in which the asci are scattered at various levels are believed to be more primitive than those which are multi- or uniloculate, with each locule containing a number of asci. Uniloculate ascocarps may become grouped and connected by vegetative hyphae, and finally may be so surrounded by stromatic tissue as to give a superficial resemblance to multiloculate ascocarps. Position of the ascocarps in relation to substrate is a variable character and apparently not of evolutionary significance.

Wall structure appears to have evolved from undifferentiated masses of cells (*textura globosa* or *textura angularis*) to compressed layers (*textura prismatica*) which may be differentiated into outer and inner regions. In some groups the surface cells are arranged as *textura epidermoidea* (Starbäck's terminology as emended by Korf, 1958). The surface of the wall may be roughened by protruding cells or by hyphal or setose appendages. So much variation is present that the character can only be utilized to distinguish species.

The simplest type of opening in an ascocarp for dissemination of ascospores is provided by the breakdown of cells above the asci, leaving a rounded, elongate, or irregular hole. More evolved is a definite pore or slit formed by an apical meristematic region. The cells surrounding such an opening differ in shape and orientation from those which form the rest of the wall. A refinement is found in those fungi in which the apical opening is lined by hyaline periphyses or short dark setae.

The locule in the most primitive Loculoascomycetes does not appear to be differentiated from the rest of the ascocarp interior, and asci may develop at various

levels or in a layer separated by sterile cells. More advanced forms have wall and locule tissue somewhat differentiated. Asci arise from a restricted group of ascogenous hyphae in the base of the locule, and compress or dissolve locule cells during their growth. As wall structure becomes more differentiated, so does the locule. This is enlarged by growth of pseudoparaphyses downward from an apical meristematic region, or elongation of cells as the ascocarp enlarges. Ascogenous hyphae in the more advanced forms may be basal or may line the sides of the locule as well. The asci elongate into the locule among the pseudoparaphyses.

The primitive ascus is nearly globose or saccate; more advanced types are broadly oblong or clavate, while in advanced members of the subclass cylindric or clavate and stipitate asci are the rule. The thickness of the double wall, except at the apex, decreases with advancing evolution. Octosporous asci are the rule; formation of fewer than eight ascospores is infrequent, and at times appears to be an accidental occurrence. Polyspory, in multiples of four, occurs in a number of genera. This condition is accepted as a generic criterion in the subclass, as it is among members of the Euascomycetes, e.g. in Coronophoraceae, Diatrypaceae, and Diaporthaceae. The evolutionary significance of polyspory is not known.

The ascospore which is proposed as primitive is globose or ovoid, thin walled, hyaline. Two series of shapes (cf. *Terminology of simple symmetrical plane shapes,* Taxon 11: 145–156, 245–247, *Chart I.* 1962) seem recognizable. Elliptic or obovate is considered to be less advanced than oblong or filiform. Accuracy in description of shape is obtained further by modifications such as narrow or broad, short or elongate, straight or inequilateral or curved, and by defining the obtuse or pointed ends of the ascospore.

Ascospore septation is a classical characteristic which has been used to delimit genera. The primitive condition is the one-celled ascospore. The numbers of species of Loculoascomycetes which have one-celled ascospores are far fewer than those which have septate ascospores, the opposite situation to that occurring in the Euascomycetes.

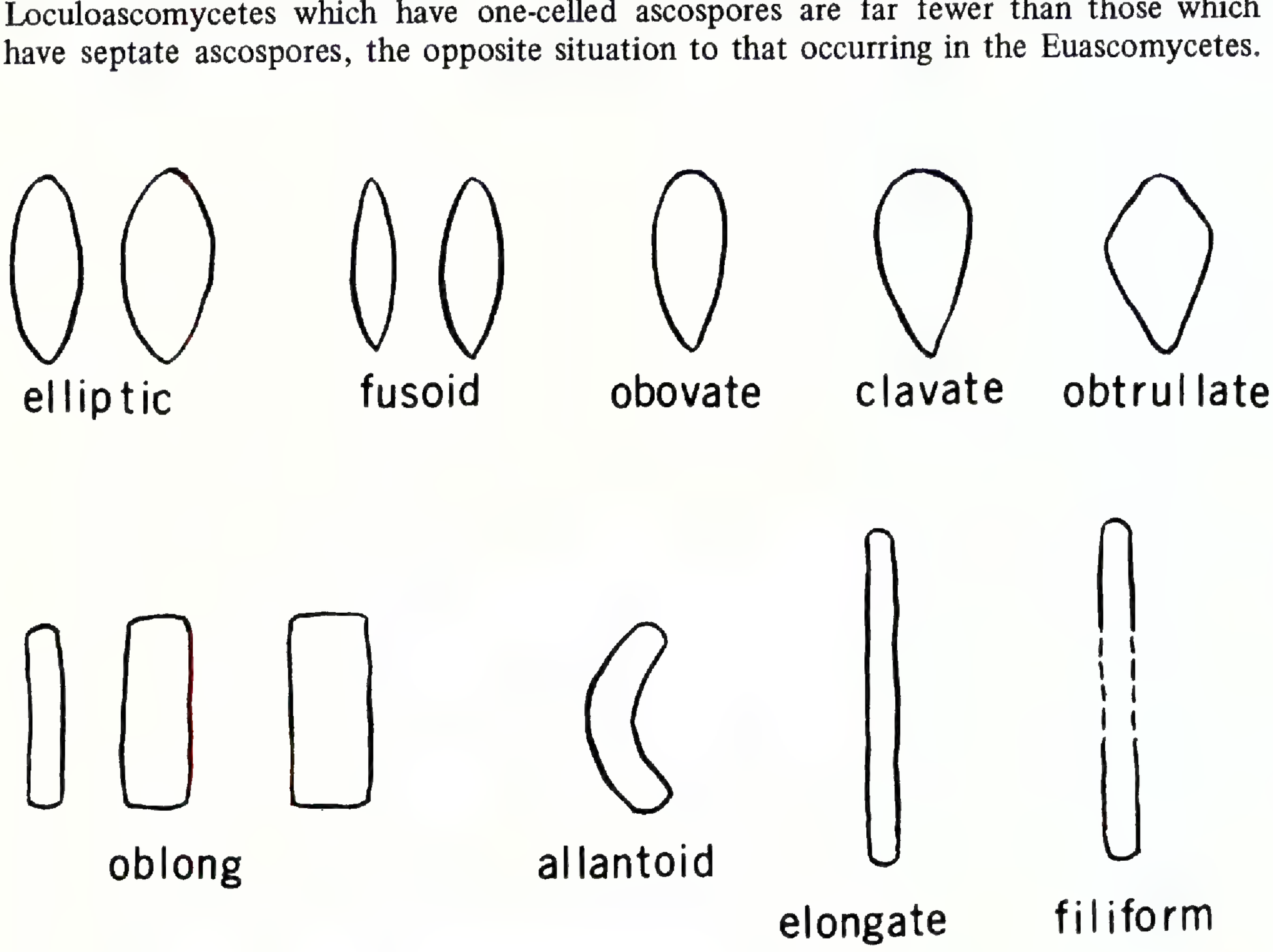

Fig. 1. Ascospore shapes and terminology.

The primary septum may be median, supramedian, or submedian, and frequently the wall is constricted at this septum. Apiospores have a very small basal cell. Secondary and tertiary septa may be inserted in a number of ways, illustrated by Holm (1957) for *Leptosphaeria* and related genera, Wehmeyer (1961) for species of *Pleospora,* and Eriksson (1967) for *Clathrospora.* The formation and insertion of vertical septa is illustrated by the latter two authors.

Hyaline or light colored ascospores appear to be more primitive than deeply pigmented ones. The pigmentation is in the cell contents or is concentrated in the ascospore wall. Ascospores which are hyaline or light colored at maturity may develop a yellowish to dull brown color, but this differs in intensity and tone from the pigment found in dark-spored species. Variations which are of specific value only include wall thickness, smooth or roughened surface, presence of a gelatinous coating or hyaline appendages.

The order Dothideales

The history of the order Dothideales and its vicissitudes throughout the years was provided in some detail by Luttrell (1951b). Luttrell at that time recognized only the families Dothideaceae and Capnodiaceae in the Dothideales. In 1955 he expanded his concept of the order to include the Pseudosphaeriaceae and Dothioraceae. The Herpotrichiellaceae he placed in the Pleosporales. Later (Luttrell, 1965) he suggested raising the Capnodiaceae to ordinal level, and including other fungi of superficial habit within that order.

Müller and von Arx (1950) placed the families Pseudosphaeriaceae, Mycosphaerellaceae, Dothideaceae, and Venturiaceae in the Pseudosphaeriales; the Botryosphaeriaceae, Dothioraceae, Hysteriaceae, and Phacidiaceae they included in the Dothiorales. Their treatment of amerosporous genera (von Arx and Müller, 1954) in the Dothiorales included the families Botryosphaeriaceae, Entopeltaceae, and Mesnieraceae. The latter two families contain no representatives within the regional scope of this study and I do not offer suggestions at present for their classification. The didymosporous genera which belong to the Loculoascomycetes were arranged by Müller and von Arx (1962) in the orders Dothiorales and Pseudosphaeriales; the Phacidiaceae were placed in the Phacidiales (Discomycetes).

From Müller and von Arx's concept of Dothiorales, some families are included in the Dothideales *sensu meo,* i.e. the Dothioraceae and Perisporiopsidaceae. Their Botryosphaeriaceae included genera which belong in the Dothioraceae in my treatment, as well as genera which appear to belong in Myriangiales or Pleosporales. The Hysteriaceae have a *Pleospora* type of development and should be assigned to the Pleosporales. The remainder of the families of Müller and von Arx's Dothiorales seems best placed in the Myriangiales in a broad sense. Their concept of the Pseudosphaeriales differs from mine of the Pleosporales in several instances. Thus, while most of the families which they included in the Pseudosphaeriales are members of the Pleosporales, in my opinion some are not. Their Capnodiaceae and Mycosphaerellaceae, i.e. Dothideaceae (*most* of the taxa) belong in the Dothideales, as do genera which Müller and von Arx placed in the Pleosporaceae such as *Monascostroma, Wettsteinina,* and *Herpotrichiella.* These differences in classification are due particularly to emphasis on the importance of sterile cells, i.e. interthecial tissues or pseudoparaphyses, or the lack of sterile cells, in the locule.

The classification of lichenized fungi should be accommodated within the framework of a general ascomycete classification (cf. Hale, 1961). In this study and through those which are planned to follow, I will attempt to arrange the lichens in the orders to which they are related according to structure of the ascocarp. Recognition of their unique biological status requires that they be retained in a separate family (or families)

within the order to which they belong in the majority of cases. Certain lichenized fungi, however, seem to differ only generically from their non-lichenized relatives, and these latter are accommodated within the non-lichenized family.

Significant characters within the Dothideales

Ascocarps

Following Holm's (1957) discussion of terminology, I am using the term "ascocarp" rather than "ascostroma" or "pseudothecium." The position of the ascocarp in relation to host tissues, i.e. whether immersed-erumpent or superficial, is a generic character within the Pseudosphaeriaceae, Dothioraceae, and Dothideaceae. Members of the Herpotrichiellaceae and Capnodiaceae are superficial on the substrate. Ascocarps are uni- or multiloculate. The characteristic of uni- or multiloculate ascocarps has been stressed at the generic level by many authors. However, it appears to be only a secondary character. Closely related species are known in which the ascocarps are uniloculate and separate, in which hyphae or massed tissue connects several ascocarps, or in which few to many locules are formed within a stromatic mass of tissue.

The ascocarp wall in the Dothideales is composed of cells which in section appear as *textura globosa* or *textura angularis,* or are compressed and form *textura prismatica.* The cells are usually thin walled but occasionally the walls are thickened and sometimes contain pores connecting adjacent cells. Pigmentation is most intense toward the periphery of the ascocarp, less so toward the interior. In a number of genera the cells are vertically oriented in rows; this is evident even at maturity in ascocarps of the Dothioraceae.

The apical opening of ascocarps is relatively simple within the order. In most members of the Pseudosphaeriaceae a small lysigenous pore is formed at maturity. Rarely, a cap-like area may dehisce, leaving a larger opening. The apex of species of the Dothioraceae opens with a small to large pore, or may weather and finally open widely and irregularly. Ascocarps of the other three families open by a small lysigenous pore at the apex.

The locule of immature ascocarps is filled by hyaline cells, either irregular or in vertical rows. Ascogenous cells are formed near the base of the locule, and young asci develop from these and protrude into the locule tissue. In the Pseudosphaeriaceae and Dothioraceae the asci occupy the entire base of the locule. The asci are relatively few in the Pseudosphaeriaceae and remnants of locule tissue (interthecial tissue) remain between them as they mature. When only mature stages of certain of the Pseudosphaeriaceae are available, it is sometimes difficult to determine that interthecial tissue is present. Then ascocarp wall, apical pore, and ascospore structure all must be considered to classify the specimen. The asci are more numerous in the species assigned to the Dothioraceae; at maturity they form a parallel group from the entire base and locule cells are completely obliterated except above the asci. In the other three families, the ascogenous cells are somewhat restricted in the base of the locule. Asci develop as a fascicle from the central part of the base, compress locule cells, and occupy the entire locule.

Asci and Ascospores

The asci of members of the Dothideales vary in shape from saccate, to clavate, or oblong. Those of the Pseudosphaeriaceae are generally broadly oblong or saccate, whereas those of the Dothioraceae are oblong or clavate. In the Dothideaceae, Herpotrichiellaceae, and Capnodiaceae saccate and oblong asci are found. The double wall of the ascus is thickened toward the apex in all members. In some members of

the Pseudosphaeriaceae the cytoplasmic plug at the apex may be surrounded by a refractive ring, but in the other families no refractive ring can be seen. The ascus base is usually foot-like, and except for some of the clavate asci of Dothioraceae, no stipe is present. Ascospore discharge has been observed in a number of species of the order. The outer wall of the ascus ruptures, sometimes at the apex or at times producing a thimble-shaped cap, and the inner wall elongates greatly (to 2–3 times its original length), carrying with it the uppermost ascospores. Normally eight ascospores are produced in each ascus, but at times only four mature, e.g. in *Dothidea puccinioides.* Taxa with polysporous asci are relatively numerous in the families Dothioraceae and Herpotrichiellaceae.

Ascospores of the Dothideales are basically elliptic or obovate. Some variation of shape is found within nearly all genera, although in the Dothioraceae the majority have obovate ascospores. Narrow elongate ascospores approaching filiform are known in *Sphaerulina* and *Polytrichiella.* The ascospores of many genera are hyaline, a number develop yellowish-brown pigmentation as they mature, and some at maturity are rich dark brown. The outer wall is usually smooth in the hyaline-spored species, but when pigmented the wall is frequently finely encrusted. A thick gelatinous coating often surrounds the ascospores of species in the Pseudosphaeriaceae and occasionally of species in the other families. Appendages are formed on the tips of ascospores in a few species of *Botryosphaeria.* The one-celled ascospore is found in only three genera, these belonging in the Dothioraceae and Dothideaceae. One-septate and several-septate or muriform ascospores characterize one or more genera in each family.

Conidial States

Knowledge of the conidial states of fungi belonging to the Dothideales is limited as relatively few connections have bewn authenticated. No generalizations can be made on the value of this character at present. Within the Pseudosphaeriaceae, only *Pyrenophora* is known to produce conidia. These are septate porospores (conidial terminology following that of Barron, 1968) and belong to the genus *Drechslera.*

Conidial states of members of the Dothioraceae may be borne within locules in stromatic tissue or on the surface of stromatic tissue. Where the conidiophores are well developed the conidia are produced successively as blown out ends of new growing points (sympodiospores) as in the *Hadrotrichum* state of *Scirrhia rimosa* or the *Dothistroma* state of *S. pini.* However, the conidiophores of most of the conidial states known in the Dothioraceae are very short and line the walls of locules. These states have been assigned to the form-genera *Dothiorella, Botryodiplodia, Macrophoma,* or *Phyllostictina,* depending on conidial septation and pigmentation. In *Dothichiza,* locule cells appear to be converted into one-celled conidia, or as von Arx (1970) illustrated, the locule cells or hyphae produce blastospores.

In the Dothideaceae species of *Mycosphaerella* have varied types of conidial states. Sympodially formed conidia are produced usually on small fascicles of conidiophores which bear scars at maturity. The conidiophores arise from an immersed stromatic complex of hyphae and are erumpent through epidermal cells or stomata of the host plant. Septation and pigmentation, or the formation of chains of blastospores, dictate the disposition of the conidial states into form-genera: *Ovularia, Ramularia, Cercospora, Cercosporella, Cercosporidium, Isariopsis, Passalora, Polythrincium, Heterosporium,* or *Cladosporium.* Annellate conidiophores are formed in *Stigmina.* Pycnidia are produced by species of *Septoria,* and acervuli by *Lecanosticta.* Conidia in these two genera arise from short sporogenous cells and could be termed blastospores. Species of *Discosphaerina* have associated conidial states produced in pycnidia of the form-genera *Selenophoma* or *Kabatia.* The only species of *Sphaerulina* presently known to have a conidial state is *S. rubi.* The conidial state was described as *Cylindrosporium rubi,* but it scarcely differs from *Septoria.* In a number of species of the Dothideaceae and

Dothioraceae, a microconidial state is also known, and is assigned to *Asteromella* or *Phyllosticta.*

No conidial state is known as yet for species of the Herpotrichiellaceae. The Capnodiaceae have varied conidial states. Pycnidia resembling the ascocarpic state but containing one-celled conidia are found in *Rhytidenglerula* and *Scorias.* Both *Aithalomyces* and *Strigopodia* have hyphomycetous conidial states. Sympodially formed phragmoconidia belonging to *Hormisciella* are associated with species of *Strigopodia,* and apparently also with *Aithalomyces.* In addition, phialides and phialospores are produced from hyphae, ascospores, and conidia of *Aithalomyces* (as *Hormisciomyces*) and of *Strigopodia* (as *Capnophialophora*).

Hosts and Substrates

The substrates of fungi assigned to the Dothideales may be found in all groups of vascular plants and also among nonvascular organisms. In general, the Pseudosphaeriaceae are most numerous on monocotyledonous hosts, but also develop in leaves or stalks of dicotyledonous herbaceous or woody plants, and to a lesser extent on gymnosperms. Members of the Dothioraceae are predominantly inhabitants of a wide variety of woody hosts both angiosperms and gymnosperms. Only a few specimens are found on monocots. The species of Dothideaceae inhabit leaves, stalks, and smaller branches of both woody and herbaceous hosts, of monocots, less often of gymnosperms, and also ferns, lycopods, and algae. In the Herpotrichiellaceae, substrates tend to be old fungi (Basidiomycetes or stromatic Euascomycetes) and much decayed wood, in addition to old woody or herbaceous plant remains. The members of the Capnodiaceae occur on resinous or insect exudates on leaves and branches of gymnosperms and woody angiosperms. Saprobes comprise the majority of species in the Dothideales. Some are known to be obligate parasites; others are facultative parasites beginning their life cycle in living plant tissues but maturing in dead tissues.

Suggested relationships of families and genera.

The relationships of families and genera seem best derived from the trends within a large genus or two central in each family. From the sequences of species in a genus interrelationship between families is extrapolated. Minor genera are envisioned as side lines within each family. In text figure 2 are summarized the relationships which are suggested below.

The Pseudosphaeriaceae include a number of taxa which are indicators of relationship to primitive members of the Myriangiales, to the Dothioraceae, and to the Dothideaceae, and possibly also to the Pleosporaceae of the Pleosporales. This family, as Luttrell (1955) remarked, could almost as well be assigned to the Pleosporales as to the Dothideales. However, the preponderance of characteristics is of the latter order.

From *Wettsteinina,* the central and most variable genus in the Pseudosphaeriaceae, several lines of development can be postulated. Production of numerous oblong to clavate asci in a basal layer and reduction in the amount of interthecial tissue remaining at maturity would yield ascocarps typical of the Dothioraceae. The species of *Wettsteinina* with saccate asci could have given rise to those of *Leptosphaerulina* and *Monascostroma.* Species in *Mycosphaerella* subgenus *Didymellina* are obviously not greatly advanced beyond the latter two genera. A third line of development in *Wettsteinina,* marked by the production of oblong asci well separated by interthecial tissue, leads to *Pyrenophora.* From this line also is an apparent connection to members of the Pleosporaceae, the resemblance particularly striking in young stages of *Pleospora sens. str.* These three lines of development in *Wettsteinina,* based on ascus shape and arrangement in the locule, are the major ones within the genus. Minor characters, such as the development of stromatic tissue in *W. sabalicola* and *W. yuccaegena,* indicate

their relationship to *Dermatina.* This lichenized genus has superficial multiloculate ascocarps and is connected to *Stomatogene. Extrawettsteinina* is distinguished from *Stomatogene* by formation of a differentiated ascocarp wall of somewhat radiating structure.

In the Dothioraceae, *Bagnisiella* is the most primitive genus according to ascus arrangement in the locule. Two parallel lines of development are discernable in the Dothioraceae, both apparently derived from *Bagnisiella. Botryosphaeria* has one-celled ascospores as does *Bagnisiella,* whereas *Dothiora* has septate ascospores. In both, variation occurs in formation of multi- or uniloculate ascocarps and in size and configuration of the locule. With decreasing size of the locule the asci become grouped more closely and parallel arrangement of asci is less recognizable. The extralimital genus *Phyllachorella,* while otherwise similar to *Botryosphaeria,* has asci arising in a small locule from a pulvinate mass of cells. Only minor differences exist between *Phyllachorella* and *Discosphaerina* in the Dothideaceae. Similarly *Saccothecium* deviates from *Dothiora* and *Columnosphaeria* from *Bagnisiella* and these approach Dothideaceae in aspect of the locule. *Scirrhia* could be derived from the compound ascocarps of several species of *Botryosphaeria;* the major distinction between the genera is the formation of one-septate or one-celled ascospores. While having the ascospore type of *Scirrhia, Coccoidella* produces a basal immersed hypostromatic foot which bears a superficial peltate multiloculate stroma. An additional variation in the family is that of polyspory. Both *Scirrhia* and *Dothiora* have polysporous counterparts, *Delphinella* and *Sydowia* respectively. The latter show the same variation in ascocarps and in ascospore septation as do their octosporous counterparts.

In the Dothideaceae *Mycosphaerella* with one-septate hyaline ascospores is the most variable and largest genus. *Didymellina* is the more primitive of the two subgenera of *Mycosphaerella,* and could be derived from one line of development in the Pseudosphaeriaceae. The species of subgenus *Mycosphaerella* may be derived from species in section *Fusispora* of subgenus *Didymellina* (and cf. Müller and von Arx 1950). The varied shapes of ascospores within the genus lead to other genera: from *Mycosphaerella* subgenus *Mycosphaerella* by way of section *Longispora*, the species of *Sphaerulina* derive by more elongate ascospores which develop additional septa. The species of *Dothidea sens. str.,* with brown ascospores and multiloculate ascocarps could be related to such species as *M. tassiana. Omphalospora* could possibly be derived from closely related species in *M.* subgenus *Didymellina,* e.g. *M. minor.* The presence of radiating mycelium beneath ascocarps of *M. minor* differs in lesser quantity from the stromatic tissue found in *Omphalospora.* In the latter ascospore septation—apiospores—is distinctive. Ascospore septation is of little assistance in considering the derivation of *Rhizogene* and *Lasiobotrys.* In these two the septum is supramedian and pigmentation is present but not heavy. The similarities of stromata and locules between *Dothidea* and *Rhizogene* would seem to link them, while ascospore type links *Rhizogene* with *Lasiobotrys.* These two genera approach the Venturiaceae of the Pleosporales in a number of characters. *Discosphaerina,* as was noted earlier, appears to be connected by way of *Phyllachorella* to *Botryosphaeria* in the Dothioraceae and is also closely related to species of *Mycosphaerella.*

The taxa in the Herpotrichiellaceae as emended here are too few to provide any definite views on their relationship. They are all similar in locule aspect to *Mycosphaerella,* differing especially in superficial habit and by the dingy pigmentation in the ascospores and ascocarp wall. Within the family, both octosporous (*Herpotrichiella*) and polysporous (*Capronia*) genera are recognized in the group whose ascospores are several-septate and often muriform. The elongate ascospores of species in *Polytrichiella* seem to indicate an end line from *Capronia.*

The emendation of the family Capnodiaceae to exclude those with a *Pleospora* developmental type of locule leaves relatively few representatives in this regional

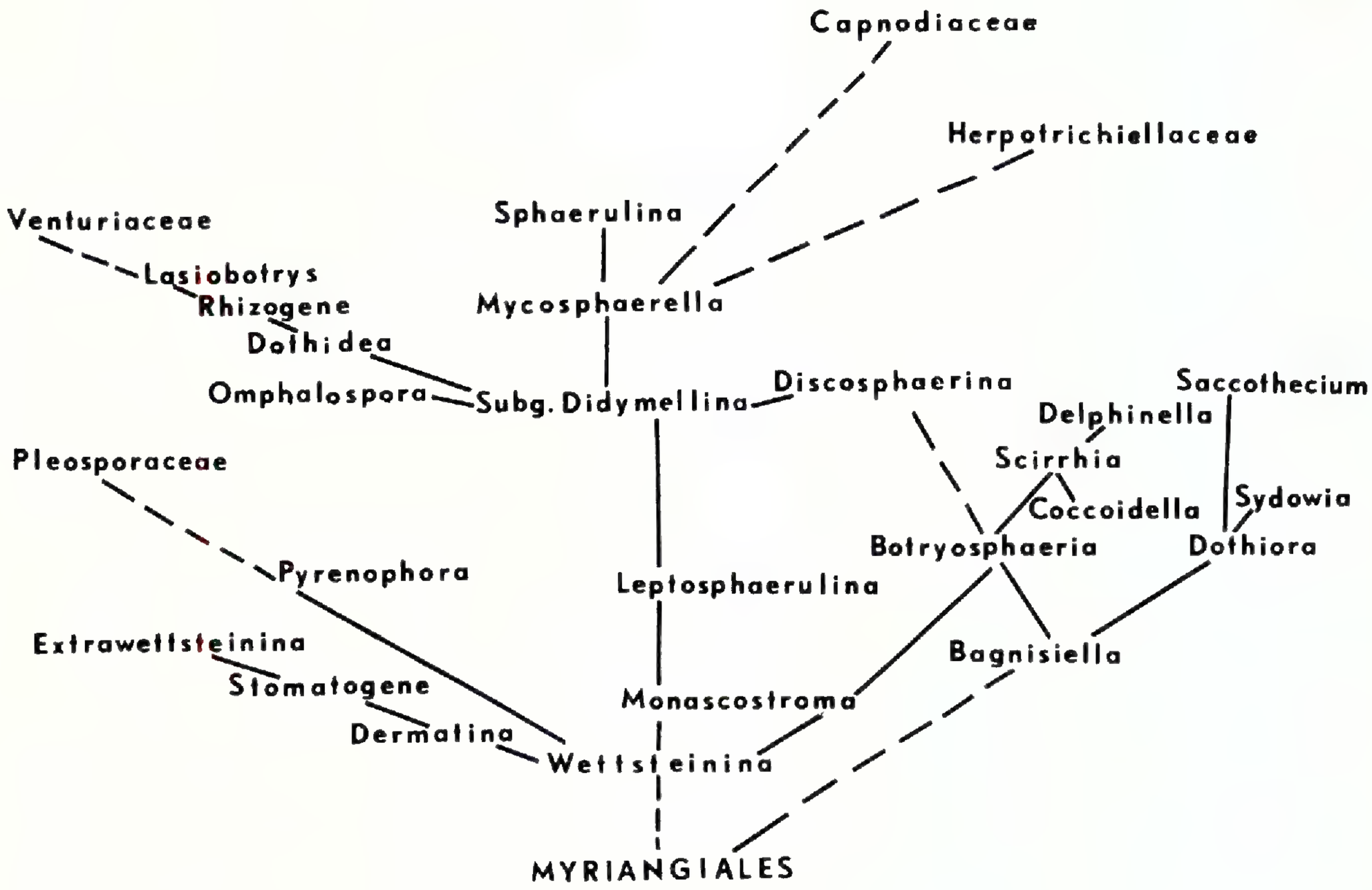

Fig. 2. Suggested relationships among families and genera of the Dothideales.

treatment. The unusual habitat, i.e. plant exudates, is an adaptation which cannot be traced presently. The north temperate species of Capnodiaceae comprise only a small percentage of the existing species and much research on extralimital taxa is necessary. The aspect of the locule is of members of the Dothideaceae. *Rhytidenglerula* deviates from the other members of the family in having light colored ascocarp wall and sparse, light colored subiculum, but is allied to *Aithalomyces* and *Strigopodia* by aspect of the depressed ascocarp, and to *Scorias* by pycnidial conidial state.

CLASSIFICATION

Dothideales Lindau in Engler & Prantl, Natürl. Pflanzenfam. I(1): 373. 1897, emend.
Pseudosphaeriales Theiss. & Syd. Ann. Mycol. 16: 6. 1918, pro parte
Capnodiales Woronichin, Ann. Mycol. 23: 178. 1925, pro parte
Dothiorales Müller & von Arx, Ber. Schweiz. Bot. Ges. 60: 389. 1950, pro parte

Key to Families of Dothideales

1. Asci developing in and separated by interthecial tissues; ascospores usually surrounded by gelatinous coating. *Pseudosphaeriaceae.*
1. Asci developing in a broad layer or a fascicle and dissolving locule tissue; ascospores rarely surrounded by gelatinous coating.
   2. Asci parallel in a broad layer from entire base of locule, or from conic or columnar basal cushion, clavate or oblong, usually short stipitate; ascocarps depressed or globose, rarely conic, opening by relatively large pore or by irregular wearing away of apex; ascospores usually containing many minute guttules. *Dothioraceae.*
   2. Asci in a fascicle from a basal cushion, saccate or oblong, usually sessile or nearly so; ascocarps variable in shape, opening by relatively small pore; ascospores usually containing one or two globules per cell.
      3. Ascocarps originating within plant tissues, often becoming erumpent but with immersed hyphae or hypostroma. *Dothideaceae.*

3. Ascocarps originating on surface of substrate; hyphae rarely penetrating substrate.
   4. Hypersaprobic on decaying plant material or old fructifications of other fungi; hyphae narrow; ascospores and often ascocarp walls tinged grayish or dull olivaceous. *Herpotrichiellaceae.*
   4. Epiphytic on living or dead plant material, often over honey-dew secretions from insects; hyphae usually broad; ascospores and ascocarp walls not tinged grayish or dull olivaceous. *Capnodiaceae.*

Pseudosphaeriaceae v.Höhnel, Sitzungsber. Kaiserl. Akad. Wiss., Math.–Naturwiss. Kl. Abt. I, 116: 129. 1907.

= *Parodiellinaceae* Arnaud, Asterinées, Thés. Paris, sér. A. No. 805: 21. 1918.
= *Parodiellinaceae* Hansford, Mycol. Pap. 15: 15. 1946.
= *Parodiopsidaceae* Luttrell, Univ. Missouri Stud. Sci. Ser. 24(3): 78. 1951.
= *Perisporiopsidaceae* Müller & von Arx, Beitr. Kryptogamenfl. Schweiz 11(2): 167. 1962.

Ascocarps uni- or multiloculate, immersed and becoming erumpent, or superficial, globose, conic, or depressed, separate or occasionally seated on hypostroma or massed together by connecting hyphae; wall thick or thin, with layers of large cells forming *textura angularis* or *textura prismatica,* the surface glabrous, setose, or with hyphal appendages, the latter sometimes conidiophorous; ascocarps opening at maturity by a small to irregular pore, rarely dehiscing at apex to leave a large opening. Asci arising from entire base of locule, saccate, oblong, or clavate, bitunicate, (4–) 8-spored, in interthecial tissues. Ascospores hyaline, yellowish, or brown, elliptic, obovate or oblong, one- to several-septate, a vertical septum frequently developed in several cells; contents homogeneous or as one or two rounded or rarely lenticular globules per cell; wall smooth or roughened, often surrounded by a gelatinous coating; spores overlapping biseriate or crowded in the ascus.

Conidial state where known hyphomycetous: *Drechslera* porospores.

On monocotyledonous leaves and culms, leaves and stalks of herbaceous or woody dicotyledonous plants, and on conifer leaves.

The family Pseudosphaeriaceae as it is interpreted here includes both immersed-erumpent and superficial taxa. This is the position which Luttrell (1955) took also. The few temperate North American representatives of superficial taxa previously assigned to Parodiellinaceae or Parodiopsidaceae or Perisporiopsidaceae are similar in internal structure to the immersed representatives of the family such as *Wettsteinina.* This family will probably be expanded considerably when extralimital taxa are studied and their relationships determined.

Key to Genera

1. Ascocarps superficial on host tissues.
   2. Ascocarps on thin crustose lichen thallus; ascospores muriform. *Dermatina.*
   2. Ascocarps not on lichen thallus; ascospores transversely septate.
      3. Ascocarps globose or depressed, walls of equal thickness, *textura angularis,* surface often roughened or short appendaged; ascospores 1 (–3)-septate. *Stomatogene.*
      3. Ascocarps conic, basal layer narrow, side wall of *textura prismatica,* surface smooth; ascospores 3–6-septate. *Extrawettsteinina.*
1. Ascocarps immersed in and often erumpent from host tissues.
   4. Ascocarps small, the wall thin; gelatinous coating around ascospores thin when present.
      5. Ascocarps depressed globose or conic; ascospores 1-septate, rarely 2–3-septate in age. *Monascostroma.*
      5. Ascocarps globose or conic; ascospores several-septate, at times vertical septum in one or more cells. *Leptosphaerulina.*
   4. Ascocarps medium-sized to large, the wall relatively thick; gelatinous coating around ascospores thick when present.
      6. Ascocarps middle-sized to large, wall rather thick, glabrous or setose. *Wettsteinina.*
      6. Ascocarps large, wall thick and sclerotial, usually setose or with conidiophores. *Pyrenophora.*

Stomatogene Theissen, Ann. Mycol. 14: 406. 1916.

Ascocarps globose or depressed, separate or grouped, superficial on dull blotches or spots formed by thin weft of dark brown mycelium whose hyphae penetrate leaf tissues through stomatal openings; superficial hyphae appressed, with upright tapering branches; wall of two to three layers of coarse, blackish brown cells with bluish tinge, *textura angularis,* roughened externally by protruding cells, often with hyphal appendages; wall cells smaller and lighter brown around inconspicuous apical pore. Asci ovate or oblong, few in interthecial tissue which is compressed between asci, bitunicate, sessile, the base foot-like. Ascospores overlapping biseriate to crowded in the ascus, obovate or elliptic, hyaline becoming brown, straight or slightly curved, 1 (–3)-septate, constricted at primary septum; contents globular; wall roughened at maturity, surrounded by a thin gelatinous coating.

Conidial state not known.

Weakly parasitic in spots in thick living leaves of monocotyledons; southern United States and tropical regions.

Müller and von Arx (1962) included this genus in the Perisporiopsidaceae, with which they replaced the Parodiellinaceae sensu Hansford (1946). Locule structure in the two species known is typically pseudosphaeriaceous.

Type species: *S. agaves* (Ell. & Ev.) Theissen.

Stomatogene agaves (Ell. & Ev.) Theissen, Ann. Mycol. 14: 406. 1916. Figures 1–3.

≡ *Asterina agaves* Ell. & Ev. Bull. Torrey Bot. Club 27: 571. 1900.
≡ *Dimerium agaves* (Ell. & Ev.) Rehm, Ann. Mycol. 12: 170. 1914.
= *Dimerosporium agavectona* Pat. & Har. Bull. Soc. Mycol. France 28: 282. 1912.

Ascocarps 110–135(–220) μ diam, 80–135 μ high, grouped on blotched spots on leaves; superficial mycelium dark brown, appressed and with erect branches, the hyphae penetrating stomatal openings but not extending deep into leaf tissue; wall 15–20 μ thick, the surface roughened with hyphal appendages and protruding cells. Asci 40–50 × 20–30 μ, ovate or oblong. Ascospores 20–28 × 6–9 μ, obovate approaching clavate, straight; septum supramedian, constricted, the upper cell broader and shorter than the lower.

On leaves of *Agave* spp., subtropical and tropical North America.

Material examined:

Dominican Republic: *R. Ciferri 2842* (NY). Mexico: *Rehm, Ascom. 2102* (NY, as *Dimerium*), *Kryptogamae exs. 2210* (NY, as *Dimerium*); *Rose,* Plants of Mexico *13063* (NY, as *Asterina*).

Additional species:

Stomatogene yuccae Hansford, Sydowia 11: 68. 1958 ["1957"].

Ascocarps 180–220 μ diam, 155–180 μ high, grouped, at times forming concentric circles on slightly raised dull brown leaf spots; thin weft of superficial mycelium appressed, with occasional erect branches, the hyphae penetrating deep into leaf tissue; spotting caused by reaction of host cells and resulting in reddish-brown cell contents; wall 15–20 μ thick, the surface roughened by protruding cells and occasional short hyphal appendages. Asci 60–80 × 20–30 μ, oblong or ovate. Ascospores 25–35 × 7–10 μ, obovate, straight to slightly curved; septum nearly median, slightly constricted; secondary septa formed in each cell in age but not constricted.

On leaves of *Yucca mohavensis* Sarg., *Y. whipplei* Torr., southwestern North America.

Material examined:

California: *Calif. Fungi 576* (isotype), *577* (NY). (Holotype in Herbarium of University of Illinois.)

The broader, darker brown ascospores of this species frequently become three-septate at maturity, whereas those of *S. agaves* remain one-septate.

Extrawettsteinina Barr, gen. nov.

Ascocarpia superficialia, conica, basi applanata, peridio tenui. Asci saccati, bitunicati, in contexto intertheciali pauci. Ascosporae hyalinae, maturitate fulvae vel brunneae, ellipticae vel obovato-clavatae, transverse septatae.

Saprophyticus insidens foliis emortuis.

Species typicum: *E. minuta* Barr, sp. nov.

Ascocarps superficial on substrate, conic, the base applanate; basal wall thin, light brown, *textura epidermoidea,* the side walls thin, the surface cells *textura prismatica,* radiating from small apical pore. Asci saccate, few in interthecial tissue, bitunicate. Ascospores crowded in the ascus, elliptic or obovate-clavate, hyaline, dull brown at maturity, transversely septate, usually constricted at the septa; contents with one large globule and small guttules in each cell; wall smooth; gelatinous coating thin when present.

Conidial state not known.

Saprobic on dead leaves of gymnosperms and angiosperms; temperate North America, Europe.

The diagnostic features which distinguish *Extrawettsteinina* are those utilized in the key to genera: the formation of conic ascocarps superficial on the substrate and the radiating arrangement of wall cells. Ascospores in the three species presently recognized are of two types. In *E. minuta* and *E. mediterranea* the ascospores are broadly elliptic and constricted at all septa. These ascospores are similar to those of species in *Wettsteinina* section *Massarioidea.* On the other hand, the ascospores of *E. pinastri* are clavate and have the primary septum supramedian, much as in the species of *Wettsteinina* section *Pseudosphaeria* or in *Leptosphaerulina pulchra.*

Extrawettsteinina minuta Barr, sp. nov. Figures 4–6.

Ascocarpia 100–115 μ diametro, conica. Asci 54–69 × 24–27 μ, bitunicati. Ascosporae 21–24 × 8–9 μ, hyalinae vel fulvae vel brunneae, ellipticae, 3-septatae, ad septa omnia constrictae.

Specimen typicum insidens foliis *Juniperi communis,* prope "trail to Lac Diable, Mont Albert, Gaspé Prov. Park, 19 Aug 1957" a *M. E. Barr* n. *2194* lectum, in herbario Univ. Mass. depositum.

Ascocarps 100–115 μ diam at base, conic, tapered from broad applanate base to apex; wall thin, light brown at base, blackish brown at sides. Asci 54–69 × 24–27 μ, occasionally with refractive ring surrounding cytoplasmic protrusion at apex. Ascospores 21–24 × 8–9 μ, hyaline, dull brown in age, broadly elliptic, straight, equally 3-septate, constricted at all septa, surrounded by a narrow gelatinous coating.

On dead leaves of *Juniperus communis* L., eastern North America.

Material examined:

Quebec: *Barr 2194* (holotype, MASS). Vermont: *Barr 4278* (MASS).

The ascospores of this species are quite similar in shape to those of *Wettsteinina mediterranea* E. Müller, which is larger in all respects. According to the description and figures, that species is also a representative of *Extrawettsteinina* and the new combination **E. mediterranea** (Müller) Barr is proposed. (Basionym: *Wettsteinina mediterranea* Müller, Sydowia 18: 92. 1965. ["1964"]). *E. mediterranea* was described from dead leaves of *Quercus ilex.*

Additional species:

Extrawettsteinina pinastri Barr, sp. nov. Figures 7–8.

Ascocarpia 100–200 μ diametro, conica. Asci 50–88 × 26–34 μ, bitunicati. Ascosporae 26–36 × 10–12 μ, hyalinae vel alutaceae, obovato-clavatae, 5–6-septatae, ad septum primum constrictae.

Specimen typicum insidens foliis *Pini strobi,* prope "Roaring Brook Road,

Conway, Massachusetts, 11 Nov 1963" a *M. E. Barr* n. *4153* lectum, in herbario Univ. Mass. depositum.

Ascocarps 100–200 μ diam at base, 100–150 μ high, conic, tapered from base to oblique apex; basal wall thin, light brown; side wall dark brown. Asci 50–88 × 26–34 μ. Ascospores 26–36 × 10–12 μ, hyaline, dull brown in age, obovate-clavate, rounded toward apex, narrowed and slightly tapered to base, 5–6-septate, the primary septum supramedian, slightly constricted; secondary and tertiary septa below the primary; gelatinous coating not present.

On fallen leaves of *Pinus strobus* L., eastern North America, *Pinus* spp., Europe.

Material examined:

Massachusetts: *Barr 4153* (type), *4154* (MASS).

This species differs in ascospore shape from the two previous species, but all are similar in ascocarps and asci. Gremmen (1960) illustrated and described the fungus as *Lophiostoma pinastri* Niessl, but that species according to descriptions is truly a *Lophiostoma.*

Monascostroma v.Höhnel, Ann. Mycol. 16: 160. 1918.

Ascocarps thickly scattered to grouped, small, immersed or erumpent, depressed globose or globose-conic; wall of several layers of dark brown cells forming *textura angularis,* glabrous, with small apical pore at maturity. Asci few, saccate or oblong, bitunicate; interthecial tissue sparse. Ascospores crowded in the ascus, hyaline, yellowish or becoming brown, elliptic, fusoid, or obovate, 1-septate, slightly constricted; 1 or 2 additional septa formed in age; contents with two large globules per cell; wall smooth or finely roughened, surrounded by a thin gelatinous coating.

Conidial state not known.

Saprobic on dead overwintered leaves, culms of monocotyledons, twigs of woody dicotyledons, leaves of conifers; temperate North America, Europe.

Monascostroma is distinguished by small ascocarps, relatively thin-walled, and the one-septate hyaline or light brown ascospores. The genus was described as having a single ascus in the locule, and this may be true in the smallest ascocarps, but usually each locule contains several (up to eight to ten) asci, separated by sparse interthecial tissue.

Type species: *M. innumerosa* (Desm.) v.Höhnel.

Monascostroma innumerosa (Desm.) v.Höhnel, Ann. Mycol. 16: 160. 1918.

≡ *Hendersonia innumerosa* Desm. Ann. Sci. Nat. Bot. ser. 3, 16:305. 1851.
≡ *Stagonospora innumerosa* (Desm.) Sacc. Syll. Fungorum 3: 451. 1884.
≡ *Phaeosphaerella innumerosa* (Desm.) Müller, Rev. Mycol. (Paris) 19: 59. 1954.
= *Mycosphaerella pheidasca* Schroet. in Cohn, Kryptogamenfl. Schlesiens 3(2):342. 1894.
≡ *Phaeosphaerella pheidasca* (Schroet.) Sacc. Syll. Fungorum 11: 312. 1895.

Ascocarps 66–120 μ diam, globose, depressed or conic. Asci 33–46.5 × 15–21 μ, one or two or up to 8 in a locule. Ascospores 15.5–24 × (4–)6–8 μ, hyaline then yellowish to brown, obovate or fusoid with pointed base, inequilateral to slightly curved; wall finely roughened in age, surrounded by gelatinous coating ca. 1 μ thick.

On *Juncus* spp., Europe, North America.

Material examined:

Europe: *Rehm, Ascomycetes 1990.* Nova Scotia: *Wehmeyer 1706* (MICH). Nebraska: Scotia, 19 Sept 1906, *J. M. Bates* (NYS, in packet of *Graphyllium chloes* var. *junci*).

The yellowish brown ascospores may develop one or two additional septa in age.

Additional species:

Monascostroma euryasca (Ellis & Galloway) Barr, comb. nov.

≡ *Didymosphaeria euryasca* Ellis & Galloway, J. Mycol. 5: 67. 1889.

Ascocarps 80–100 μ diam, globose-conic. Asci 33–47 × 12–14.5 μ. Ascospores 12–14.5 × 4–5.5 μ, brown, elliptic-obovate, the ends tapered but obtuse; gelatinous coating 1–1.5 μ thick.

On leaves of *Pinus contorta* Dougl. var. *latifolia* Engelm., western North America.

Material examined:

Montana: summit of Mt. Helena, Lewis and Clarke Co., 14 Sept 1887, *Anderson* (holotype, NY).

The small, relatively thick walled ascocarps and the presence of interthecial tissue in the locule force the removal of this fungus from *Didymosphaeria.* The ascospores are a rich brown in the type collection, the only one seen.

Monascostroma pruni Barr, sp. nov. Figures 9–11.

Ascocarpia (70–)80–110 μ diametro, globosa vel late conica. Asci 33–53 × 9–13.5 μ, pauci, bitunicati. Ascosporae 12–18.5 × 4–5 μ, hyalinae, elliptico-obovatae, uniseptatae.

Specimen typicum in ramis emortuis *Pruni pensylvanicae,* prope "Stony Brook Trail, near Gorham, New Hampshire, 26 July 1963," a *M. E. Barr* n. *3996* lectum; in Herbario Univ. Mass. depositum.

Ascocarps (70–)80–110 μ diam, globose-conic. Asci 33–53 × 9–13.5 μ. Ascospores 12–18.5 × 4–5 μ, hyaline, elliptic-obovate, tapered to obtuse ends, straight to inequilateral; gelatinous coating 1 μ thick.

On dead branches of *Prunus pensylvanica* L., eastern North America.

Material examined:

New Hampshire: *Barr 3996* (type, MASS).

The thickly grouped ascocarps form roughened areas or bands extending entirely around small twigs.

Leptosphaerulina McAlpine, Fungous diseases of stone-fruit-trees in Australia 103. 1902.

= *Scleropleella* v.Höhnel, Ann. Mycol. 16: 158. 1918.
  ≡ *Leptosphaeria* subgenus *Scleropleella* (v.Höhnel) Müller, Sydowia 4: 214. 1950.
= *Pseudoplea* v.Höhnel, Ann. Mycol. 16: 162. 1918.
= *Pleospora* section *Pseudopleella* Müller, Sydowia 5: 265. 1951.

Ascocarps small, globose or conic, immersed becoming erumpent; wall thin, with one to three layers of brown cells, *textura angularis,* the surface glabrous; apical pore opening widely at maturity. Asci few, saccate or oblong, bitunicate, in interthecial tissue which is often entirely obliterated at maturity. Ascospores overlapping biseriate or crowded in the ascus, hyaline or yellowish or brown, obovate to elliptic or clavate, several-septate, usually with vertical septum in one or more of mid cells; wall smooth or roughened at maturity, at times surrounded by a thin gelatinous coating.

Conidial state not known.

Parasitic or saprobic on leaves, culms, stalks, or small branches of monocotyledons and dicotyledons; widespread and apparently cosmopolitan in subarctic and temperate regions.

Scleropleella was erected to accommodate *S. personata* (Niessl) v.Höhnel. This species differs only in ascospore septation from *Leptosphaerulina australis.* Müller (1950) regarded *Scleropleella* as a subgenus of *Leptosphaeria,* but designated *L. salebricola* as type of the subgenus. His account of the species included *S. personata.* The majority of species which he placed in the subgenus are pleosporaceous and belong in *Phaeosphaeria* (Holm, 1957).

Von Höhnel's *Pseudoplea,* with the type species *P. briosiana,* is a parasitic fungus which develops in living tissues. Its morphology is similar to that of *Leptosphaerulina*

australis. Graham and Luttrell (1961) relegated *Pseudoplea* to the synonymy of *Leptosphaerulina.*

Mycotodea Kirschst. (Ann. Mycol. 34: 201. 1936) was erected on a theoretical basis, since Kirschstein had seen none of the species which he transferred to the genus. *M. heufleuri* (Niessl) Kirschst. was designated the type species, and *M. pulchra* (Winter) Kirschst. and *M. hyperborea* (Fuckel) Kirschst. were also included in the genus. *M. heufleuri* may be a species of *Phaeosphaeria* according to information in the literature, but the other two entities belong in *Leptosphaerulina.* Petrak (1940) considered *Mycotodea* a synonym of *Leptosphaeria,* or of *Scleropleella* if that genus were to be maintained. Müller (1951b) regarded *Mycotodea* as synonymous with *Leptosphaeria* subgenus *Scleropleella.*

Key to Sections

1. Ascospores transversely septate, vertical septa lacking; saprobic species. Section *Scleropleella.*
1. Ascospores both transversely and vertically septate.
   2. Saprobic species. Section *Leptosphaerulina.*
   2. Parasitic species, often forming spots in living leaves. Section *Pseudoplea.*

Leptosphaerulina section **Leptosphaerulina**

Saprobic in overwintered leaves of stalks; ascospores with vertical septum in one or more of mid cells.

Type species: *L. australis* McAlpine.

Leptosphaerulina australis McAlpine, Fungous diseases 103. 1902. For synonymy, see Graham and Luttrell (1961).

Ascocarps 40–170 μ diam. Asci 50–90 × 30–45 μ. Ascospores 25–40 × 10–15 μ, hyaline or light brown, obovate, (3–)4 (–6)-septate, with vertical septum in one or more of mid cells.

On *Rosa* spp., *Prunus* spp., culms of Gramineae, North America, Europe, Australia, Asia.

Graham and Luttrell (1961) provided a detailed description and illustrations of this species. The development of the ascocarp has been described and illustrated by Müller (1951a, 1966) and Wehmeyer (1955).

Two other species in this section of the genus, *L. americana* (Ell. & Ev.) Graham & Luttrell and *L. argentinensis* (Speg.) Graham & Luttrell were also described in Graham and Luttrell's paper.

Additional species:

Leptosphaerulina pulchra (Wint.) Barr, Contr. Inst. Bot. Univ. Montréal 73: 7. 1959. Figures 12–14.

This minute subarctic-subalpine species occurs on a number of host plants especially Rosaceae and Compositae, in North America and Europe. For description and synonymy see Barr (1959).

Leptosphaerulina section **Pseudoplea** (v.Höhnel) Barr, comb. nov.

≡ *Pseudoplea* v.Höhnel, Ann. Mycol. 16: 162. 1918.

Parasitic, often forming spots in living leaves; ascospores with vertical septum in one or more cells.

Type species: *L. briosiana* (Poll.) Graham & Luttrell, Phytopathology, 51: 685. 1961.

L. briosiana develops in leaves of *Medicago* and *Trifolium* and has been found in Europe, North America, and South America. Graham and Luttrell (1961) described the species and gave synonymy.

Other species in the section described by Graham and Luttrell are *L. trifolii* (Rostrup) Petrak and *L. arachnidicola* Yen, Chen & Huang. *L. myrtillina* (Sacc. & Fautr.) Petrak (1959b) is a European species which forms spots in leaves of *Vaccinium myrtillus.* The ascospores are similar to those in species of *Pyrenophora,* but the ascocarps are small and thin walled as in *Leptosphaerulina.*

Leptosphaerulina section **Scleropleella** (v.Höhnel) Barr, comb. nov.

≡ *Scleropleella* v.Höhnel, Ann. Mycol. 16: 158. 1918.

Saprobic in overwintered leaves, stalks, or culms; ascospores transversely septate, without vertical septum.

Type species: *L. personata* (Niessl) Barr.

Leptosphaerulina personata (Niessl) Barr, comb. nov.

≡ *Leptosphaeria personata* Niessl in Rabenh. Fungi europaei n. 1933; Bot. Jahresber. (Just) 2: 262: 1875.
≡ *Scleropleella personata* (Niessl) v.Höhnel, Ann. Mycol. 16: 158. 1918.
≡ *Mycotodea personata* (Niessl) Kirschst. Kryptogamenfl. Mark Brandenburg 7(3): 433. 1938.

Ascocarps 50–156 μ diam, 78–104 μ high, globose or depressed, immersed; wall 6–10 μ thick, of two layers of slightly compressed brown cells; yellowish brown hyphae forming a thin weft over the wall and into leaf tissues. Asci 33–60 × (10.5–)13–25 μ, saccate. Ascospores 15–22.5 × 4.5–7 μ, hyaline, soon brown, obovate, straight to inequilateral, (1-, 2-)3-septate, constricted at the primary septum which is supramedian, with upper portion broader than lower; wall finely roughened at maturity, surrounded by a thin gelatinous coating.

On culms of *Deschampsia caespitosa* (L.) Beauv., Europe, North America.

Material examined:

Europe: *Rabenhorst, Fungi eur. 1933* (isotype, NY). Quebec: *Barr 1962* (DAOM, MASS, as *Leptosphaeria eustoma*).

Leptosphaerulina personata resembles *Monascostroma innumerosa,* but differs especially in having somewhat larger ascocarps containing relatively numerous asci in interthecial tissue; *M. innumerosa* has few asci in the locule. The ascospores are quite similar in size and shape in the two species. Those of *M. innumerosa* are one-septate with one or two additional septa in age at times, whereas those of *L. personata* are three-septate early in development.

Additional species:

Leptosphaerulina hyperborea (Fuckel) Barr, comb. nov. Figure 15.

≡ *Pleospora hyperborea* Fuckel in Bonorden & Fuckel, Pilze *in* Zweite Deutsche Nordpolfahrt. Geog. Ges. Gremen 2: 92. 1874.
≡ *Leptosphaeria hyperborea* (Fuckel) Berl. & Vogl. Addit. Syll. Fungorum 140. 1886.
≡ *Mycotodea hyperborea* (Fuckel) Kirschst. Ann. Mycol. 34: 201. 1936.
= *Leptosphaeria brachyasca* Rostr. Meddel. Grønland 3: 618. 1891.

This species has ascospores similarily shaped to those of *L. personata* but the sizes are larger in well-developed specimens. The ascocarps in *L. hyperborea* are often conic and erumpent rather than depressed globose and immersed as in *L. personata.* The species was described from a number of woody dictoyledonous hosts from subarctic North America (Barr 1959).

Wettsteinina v.Höhnel, Sitzungsber. Kaiserl. Akad. Wiss. Math.-Naturwiss. Kl. Abt. I, 116: 126. 1907.

= *Pseudosphaeria* v.Höhnel, Sitzungsber. Kaiserl. Akad. Wiss. Math.-Naturwiss. Kl. Abt. I, 116: 129. 1907.

Ascocarps usually uniloculate, middle-sized to large, globose, conic, or depressed, immersed becoming erumpent, occasionally few grouped and connected by hyphae; wall relatively thick, with several layers of cells forming *textura angularis,* the surface glabrous or with hyphal or setose appendages; ascocarps opening by small often irregular pore or at times the entire apex cap-like and dehiscing to leave a broad opening. Asci few, saccate, oblong, or clavate, bitunicate, in interthecial tissues. Ascospores crowded in the ascus, hyaline or yellowish brown or dark brown, narrowly or broadly elliptic, or obovate, one- to several-septate, deeply constricted at primary septum; secondary septum formation frequently delayed and evident only as ring-like constrictions in cells; vertical septum in one or few mid cells when present; wall smooth or roughened, usually surrounded by a gelatinous coating; contents with large rounded or rarely lenticular globules.

Conidial state not known.

Mostly saprobic on a wide range of monocotyledons and dicotyledons on overwintered leaves and stalks, rarely on woody substrata; widespread and apparently cosmopolitan in subarctic regions, less frequent in temperate regions.

Von Höhnel (1907a,b) based the family Pseudosphaeriaceae on *Wettsteinina* and *Pseudosphaeria.* The only difference between the two genera was in the formation of vertical septa in the ascospores of *Pseudosphaeria.* Petrak (1947) concluded that *Pseudosphaeria* was synonymous with *Wettsteinina,* and that *Wettsteinina* could be distinguished from *Pseudoplea* (i.e. *Leptosphaerulina*) by larger thick walled ascocarps.

Key to Subgenera and Sections

1. Ascocarps on strand-like branched stromatic tissue; ascospores septate early with both transverse and vertical septa. Subgenus *Wettsteiniella.*
1. Ascocarps not formed on stromatic tissue of strand-like structure; ascospores often tardily septate; vertical septa infrequently formed. Subgenus *Wettsteinina.*
   2. Primary septum of ascospores nearly median, secondary septum or ring-like constriction formed in each cell, vertical septum rarely in mid cells. Section. *Massarioidea.*
   2. Primary septum of ascospore supramedian.
      3. One or more secondary septa or ring-like constrictions formed in equal numbers in upper and lower portions of ascospore. Section *Wettsteinina.*
      3. Secondary septa or ring-like constrictions more numerous in lower than upper portion of ascospore. Section *Pseudosphaeria.*

No representatives of *Wettsteinina* subgenus *Wettsteiniella* Petrak, Sydowia 9: 578. 1955, are known as yet from North America. *W. carinthiaca* Petrak, the type of the subgenus, is distinguished by forming a branched stroma of parallel hyphae in or on the edges of which ascocarps develop, and by ascospores which are septate both transversely and vertically early in development.

Wettsteinina subgenus **Wettsteinina.**

Ascocarps immersed to erumpent, often with brown hyphae or at times with stromatic connecting tissue; ascospores variable in septation.

Wettsteinina subgenus **Wettsteinina** section **Wettsteinina.**

Ascospores with supramedian primary septum; one or more secondary septa or ring-like constrictions formed in each portion.

Type species: *W. gigaspora* v.Höhnel.

Wettsteinina gigaspora v.Höhnel, Sitzungsber. Kaiserl. Akad. Wiss. Math.-Naturwiss. Kl. Abt. 1, 116: 126. 1907. Figure 19.

= *Pleospora hoehneliana* Petrak, Ann. Mycol. 25: 207. 1927.

Ascocarps (245–)400–700 μ diam, 165–300 μ high, depressed globose; wall 60–70 μ thick, bearing scattered brown hyphae in plant tissues. Asci 100–252 × (36–)80–140 μ, broadly oblong to saccate. Ascospores (37.5–)72–120 × (9–)16–44 μ, hyaline, elliptic fusoid when young, becoming obovate (the ends obtuse) straight or inequilateral, deeply constricted at supramedian primary septum, with two secondary ring-like constrictions formed in each cell; gelatinous coating 6–9 μ thick.

On overwintered monocotyledons or herbaceous dicotyledons, Europe, North America.

Material examined:

Quebec: *Barr 1929B,* on *Coptis groenlandica* (Oeder) Fern. (DAOM, MASS). British Columbia: *Barr 606,* on *Aquilegia formosa* Fisch. (MASS).

The ascospores remain one-septate for a long time, with only the ring-like constrictions to indicate the eventual position of secondary septa.

Additional species:

Wettsteinina niesslii Müller, Sydowia 4: 204. 1950.

= *Leptosphaeria gigaspora* Niessl in Rabenh. Fungi europaei n. 2998. 1882.

Ascocarps 165–400 μ diam, globose to depressed; wall 16–35 μ thick. Asci 80–160 × 21–38 μ, broadly oblong. Ascospores 52–67 × (4.5–)6–14 μ, hyaline or yellowish, elongate elliptic-fusoid (the ends pointed), 1–3-septate, finally 6–7(–8)-septate, constricted at primary septum; wall smooth, the gelatinous coating 3–4.5 μ thick.

On monocotyledon stalks, Europe, North America.

Material examined:

Northwest Territories: *Bartlett 3275,* on *Carex* sp. (MICH). Quebec: *Barr 1956,* on *Eriophorum angustifolium* Honckeny (MASS).

The ascospores in the collection on *Carex* are more fully matured and have more secondary septa than had been observed previously. The description of *Mycosphaerella bacillifera* (Karst.) Müller & Poelt, Mitt. Bot. München 5: 136. 1963, is reminiscent of this species, but I have not examined any specimens referable to *M. bacillifera.*

Other species of *Wettsteinina* which are unknown from North America as yet appear to belong in this section: *W. ambigua* Petrak, Ann. Mycol. 22: 59. 1924, and *W. winteri* (Niessl) Müller, Sydowia 4: 203. 1950.

Wettsteinina subgenus **Wettsteinina** section **Pseudosphaeria** (v.Höhnel) Barr, comb. nov.

≡ *Pseudosphaeria* v.Höhnel, Sitzungsber. Kaiserl. Akad. Wiss. Math.-Naturwiss. Kl. Abt.I, 116: 129. 1907.

Ascospores with supramedian primary septum, secondary septa or ring-like constructions more numerous in lower than upper portion.

Type species: *W. pachyasca* (Niessl) Petrak.

Wettsteinina pachyasca (Niessl) Petrak, Sydowia 1: 56. 1947.

≡ *Leptosphaeria pachyascus* Niessl, Oesterr. Bot. Z. 31: 345. 1881.
≡ *Metasphaeria pachyasca* (Niessl) Sacc. Syll. Fungorum 2: 171. 1883.
≡ *Pseudosphaeria pachyasca* (Niessl) v.Höhnel, Sitzungsber. Kaiserl. Akad. Wiss. Math.-Naturwiss. Kl. Abt. I, 116: 129. 1907.
≡ *Saccothecium pachyasca* (Niessl) Kirschst. Ann. Mycol. 37: 105. 1939.
= *Sphaerulina callista* Rehm, Hedwigia 21: 122. 1882.
≡ *Pseudosphaeria callista* (Rehm) v.Höhnel, Sitzungsber. Kaiserl. Akad. Wiss. Math.-Naturwiss. Kl. Abt. I, 116: 129. 1907.
≡ *Saccothecium callistum* (Rehm) Kirschst. Ann. Mycol. 37: 105. 1939.
≡ *Wettsteinina callista* (Rehm) Petrak, Sydowia 1: 55. 1947.

Ascocarps 100–200(–280) μ diam, globose, depressed, or conic; wall relatively thin. Asci 140–170 × 40–70 μ, oblong or saccate. Ascospores (35–)45–84 ×12–18 μ, hyaline, obovate, 6-septate, with two septa above and three below primary septum, the cell above the primary septum enlarged.

On herbaceous stalks, Europe, Asia.

This species is not known as yet from North America, and synonymy and description are taken from recent European literature. The number of septa in the ascospores separates *W. pachyasca* from the following species of the section.

Additional species:

Wettsteinina mirabilis (Niessl) v.Höhnel, Sitzungsber. Kaiserl. Akad. Wiss. Math.-Naturwiss. Kl. Abt. I, 116: 635. 1907. Figures 16–18.

≡ *Leptosphaeria mirabilis* Niessl. Hedwigia 20: 97. 1881.
≡ *Pleospora mirabilis* (Niessl) Petrak, Ann. Mycol. 25: 207. 1927.
= *Massarina gigantospora* Rehm in Voss, Verh. Zool.-Bot. Ges. Wien 37: 216. 1887.
≡ *Wettsteinina gigantospora* (Rehm) v.Höhnel, Sitzungsber. Kaiserl. Akad. Wiss. Math.-Naturwiss. Kl. Abt. I, 116: 129. 1907.
= *Sphaerulina callista* var. *vossii* Rehm in Voss, Verh. Zool.-Bot. Ges. Wien 37: 220. 1887.
≡ *Wettsteinina vossii* (Rehm) v.Höhnel, Sitzungsber. Kaiserl. Akad. Wiss. Math.-Naturwiss. Kl. Abt. I, 116: 129. 1907.

Ascocarps 120–210 μ diam, globose; wall relatively thin. Asci 75–150 × 45–66 μ, saccate or broadly oblong. Ascospores (46.5–)54–83 × (10.5–)12–27(–33) μ, hyaline, finally dull dark brown, broadly obovate-elliptic, constricted at primary supramedian septum, with one secondary constriction or septum above and two below the primary; wall finely or coarsely roughened at maturity, the gelatinous coating 2.5–6 μ thick.

On herbaceous dicotyledon stalks and leaves, Europe, North America.

Material examined:

Newfoundland: Fort McKenzie, 8 June 1955, *Wilce,* on *Viola* sp.; *Rouleau 430a,* on *Dryas integrifolia* Vahl. Quebec: *Barr 2266,* on *Artemisia canadensis* Michx. (all in DAOM, MASS).

Müller and von Arx (1962) relegated *Eriosphaeria herbarum* Wehm. and *E. macrospora* Wehm. to the synonymy of *W. mirabilis.* However, ascospore septation of the Wehmeyer specimens differs from that of *W. mirabilis* and I believe that they belong in the next section of the genus.

Wettsteinina engadinensis Müller, Sydowia 4: 202. 1950.

Ascocarps 220–300 μ diam, globose with apex somewhat elongated; wall 16–20 μ thick. Asci 130–150 × 24–32 μ, broadly oblong. Ascospores 42–57 × 8–10.5 μ, yellowish, elongate elliptic, straight to inequilateral, slightly constricted at supramedian primary septum, with one secondary septum above the three below the primary septum, the cell above the primary septum slightly broader than the others; wall smooth, the gelatinous coating thin, ca. 2 μ thick.

On dicotyledon herbaceous stalks, Europe, North America.

Material examined:

Newfoundland: near Cooke Harbor, 14 August 1957, *Wilce,* on *Epilobium latifolium* L. (MASS).

Narrower, paler ascospores distinguish this species from *W. mirabilis.* Holm (1961) considered that *W. engadinensis* was closely related to and probably conspecific with *Nodulosphaeria kümmerlei* Moesz. The major differences between the European and North American collections of *W. engadinensis* seem to lie in larger sizes of ascocarps and asci of the Newfoundland material. The ascospores of all three entities are quite similar, five-septate with the second cell enlarged. In *N. kümmerlei* on *Campanula* leaves they measure 35–45 × 7.5–10.5 μ and have terminal almost globose gelatinous appendages, 7–9 μ in diameter (Holm 1961). In *W. engadinensis* on *Aster* stalks they

measure 39–52 × 12–13 μ and are surrounded by a gelatinous coating which is enlarged to caplike ends (Müller 1950). In the Newfoundland collection they measure 42–57 × 8–10.5 μ and the gelatinous coating is equally 2 μ thick.

Wettsteinina eliassonii Petrak, Sydowia 9: 491. 1955, was described as parasitic in leaves of *Saussurea* and *Crepis* in Europe. The species appears to belong in section *Pseudosphaeria.*

Wettsteinina subgenus **Wettsteinina** section **Massarioidea** Barr, sect. nov.

Ascosporae ellipticae obovate, septum primum medium, septa secondaria una per cellulum.

Species typicum: *W. dryadis* (Rostr.) Petrak.

Ascospores elliptic-obovate; primary septum median or nearly so; one secondary septum or ring-like constriction in each half, occasionally a vertical septum in one or both mid cells.

Several groups of species are recognized in this section and are designated as series:

1. Series of *W. dryadis:* Ascocarps globose to conic, the apex papillate; ascospores elliptic-obovate, the cells nearly equal in length.

Wettsteinina dryadis (Rostr.) Petrak, Sydowia 1: 322. 1947.

This species is found on leaves of *Dryas* spp. in Europe, Asia, and North America. For synonymy and description see Barr (1959). An additional collection is: British Columbia: Field, 11 Sept 1925, *collector unknown* (UBC).

Wettsteinina andromedae (Auersw.) Barr, Contr. Inst. Bot. Univ. Montréal. 73: 8. 1959, var. **andromedae**.

Synonymy and a description are provided by Barr (1959).

Wettsteinina andromedae (Auersw.) Barr, var. **cassiopes** (Dearn. & House) Barr, Canad. J. Bot. 45: 1041. 1967.

This variety was described and discussed recently (Barr 1967).

Wettsteinina eucarpa (Karst.) Müller & von Arx, Ber. Schweiz. Bot. Ges. 60: 335. 1950.

W. eucarpa was described by Müller and von Arx (1950, 1962) and by Barr (1959).

Wettsteinina sieversiae (Peck) Barr, Canad. J. Bot. 45: 1042. 1967.

Synonymy, description, and discussion of the species are provided by Barr (1967).

Wettsteinina ellisii Barr, sp. nov. Figure 20.

Ascocarpia 180–200 μ diametro, 170–200 μ alta, globosa vel depressa, immersa vel erumpentia, peridio 30–40 μ crasso. Asci 70–88 × 22–25 μ, oblongi vel saccati, pauci, bitunicati. Ascosporae 23–28.5 μ longae, supra 9–10 μ latae, infra 7.5–8 μ latae, brunneae, obovatae, 3-septatae, strato gelatinoso 2–3 μ crasso obductae.

Specimen typicum in foliis emortuis *Pini contortae* var. *latifoliae,* prope "summit of Mt. Helena, Lewis and Clarke Co., Montana, 14 Sept 1887," legit *F. W. Anderson* n. *403*; in Herb. New York Botanical Garden depositum.

Ascocarps 180–200 μ diam, 170–200 μ high, globose or very slightly depressed, immersed becoming erumpent, seriate in small groups of 2–3 or more; walls grown together at times, the apex plane; wall 30–40 μ thick, of 4–6 layers of dark brown, polygonal cells. Asci 70–88 × 22–25 μ, oblong saccate, few. Ascospores 23–28.5 μ long, 9–10 μ wide above, 7.5–8 μ wide below, yellowish brown or dull brown,

obovate, straight to inequilateral, 3-septate, constricted at the primary septum; wall smooth, the gelatinous coating 2–3 μ thick; each cell with a large globule.

On dead leaves of *Pinus contorta* Dougl. var. *latifolia* Engelm., western North America.

Material examined:

Montana: *F. W. Anderson, Parasitic Fungi of Montana 403* (type, NY, as *Didymosphaeria euryasca*).

This species is described from material which also bears the type specimen of *Didymosphaeria euryasca* Ellis & Galloway (see *Monascostroma euryasca*). From my observations on the material, this species is more conspicuous than the one which was originally described. However, there is no mention of the *Wettsteinina* in the type description of *D. euryasca,* nor are the two fungi confused in the description.

2. Series of *W. operculata*: Ascocarps depressed-globose, the apex rounded or plane, occasionally papillate; ascospores elliptic-obovate, occasionally fusoid, the cells nearly equal in length.

Wettsteinina operculata Barr, sp. nov.

Ascocarpia 120–280 μ diametro, 100–230 μ alta, globoso-depressa, immersa vel erumpentia; apex plano-papillatus, dehiscens et latam aperturam formans, peridio 13–24 μ crasso. Asci 77–140 × 22–42 μ, oblongi, bitunicati. Ascosporae 24–50 × (5.5–)10–16.5 μ, hyalinae tarde brunneae, ellipticae, 1-septatae vel tarde 3-septatae, strato gelatinoso 2–7.5 μ crasso obductae.

Specimen typicum in foliis emortuis *Triglochinis maritimae,* prope "Seal Cove Pond, Newfoundland, 11 July 1957" legit *R. T. Wilce*; in Herb. Univ. Mass. depositum.

Ascocarps 120–280 μ diam, 100–230 μ high, depressed globose, immersed to erumpent, the apex broadly papillate and ± plane, dehiscent at times as a lid-like "operculum" and then opened widely; wall relatively thin, 13–24 μ thick, of dark to light brown polygonal cells, bearing brown hyphae in leaf tissue. Asci 77–140 × 22–42 μ, broadly oblong. Ascospores 24–50 × (5.5–)10–16.5 μ, hyaline, finally brown after discharge, elliptic, straight to slightly curved; primary septum nearly median, one ring-like constriction formed in each cell and the spores finally 3-septate; wall smooth to finely roughened, the gelatinous coating 2–7.5 μ thick.

On overwintered leaves and culms of monocotyledons, North America.

Material examined:

Northwest Territories: *Savile 3759A* on *Arctagrostis latifolia* (R.Br.) Griseb., *4191G* on *Puccinellia angustata* (R.Br.) Rand & Redf. (DAOM). Newfoundland: Seal Cove Pond, 11 July 1957, *Wilce,* on *Triglochin maritima* L. (type, MASS).

This species was at first confused with *W. macrotheca,* but the ascospores of the two differ in shape and in insertion of secondary septa. Those of *W. macrotheca* are oblong, straight, with the mid cells shorter than the end cells, while the ascospores of *W. operculata* are elliptic, curved, and have the secondary septa nearly median in each cell. The specific epithet of this new species refers to the cap-like structure at the apex of the ascocarps. At maturity the entire cap may fall, leaving a broad pore. A similar cap-like apex was reported on ascocarps of *Clathrospora heterospora* var. *simmonsii* (Corlett 1967).

Wettsteinina yuccaegena Barr, sp. nov.

Ascocarpia 275–550 μ diametro, 275–330 μ alta, globoso-depressa vel elongata, immersa, peridio 32–39 μ crasso. Asci 65–80 × 23–30 μ, clavati, bitunicati. Ascosporae 32–38 × 9–11 μ, hyalinae vel fulvae vel brunneae, ellipticae, uniseptatae.

Specimen typicum in foliis emortuis *Yuccae glaucae,* prope "Manhattan, Kansas,

Sept 1884" a *W. A. Kellerman* lectum, sub nomine *Coniothyrium herbarum Ell. & Ev. N.A.F. 1366*; in herb. Univ. Mass. depositum.

Ascocarps 275–550 μ diam, 275–330 μ high, depressed globose or at times elongate, immersed beneath the cuticle, scattered to grouped; wall 32–39 μ thick, bright brown, composed of large cells with vinaceous tinge, blackened at upper sides and in hyphae packing epidermal cells, thinner and light colored over the plane apex. Asci in a single locule or several small locules, 65–80 × 23–30 μ, short clavate. Ascospores 32–38 × 9–11 μ, hyaline or yellowish or light dull brown, elliptic, 1-septate, slightly constricted at the septum; no gelatinous coating seen.

On dead leaves of *Yucca glauca* Nutt., North America.

Material examined:

Kansas: *Ell. & Ev. N.A.F. 1366* as *Coniothyrium herbarum* Ell. & Ev. (holotype in MASS).

This fungus seems best considered as a species of *Wettsteinina,* even though no ascospores were found with more than one septum. The material appears to be somewhat immature, and older specimens may have ascospores with additional septa. The aspect of the ascocarps, both under a dissecting microscope and under 100X magnification in section, is similar to that of *Kellermannia anomala* (Cooke) v.Höhnel. The latter fungus produces within a locule elongate, one-septate conidia bearing a slender apical appendage.

Wettsteinina sabalicola (Earle) Barr, comb. nov.

≡ *Gnomonia sabalicola* Earle, Bull. Torrey Bot. Club 25: 361. 1898.

Ascocarps in groups up to 3–5 mm wide, visible as grayish blotches, subepidermal, 170–250 μ diam, 100–150 μ high, depressed globose, produced in and connected by stromatic tissue of upright rows of brown cells forming *textura prismatica*; lower portion less compact, penetrating to 500 μ deep in leaf parenchyma, surrounding but not entering scattered vascular bundles; apical pores stuffed with small cells, or tips of interthecial tissues. Asci 50–65 × 20–28 μ, broadly oblong to saccate. Ascospores 23–30 × 6.5–14.5 μ, hyaline, elliptic, straight to inequilateral, 1 (–3)-septate, constricted at the primary septum; gelatinous coating 2–3 μ thick.

On leaves of *Sabal adansoni* Guerns., North America.

Material examined:

Alabama: Auburn, Lee Co., 25 Apr 1896, *F. S. Earle* (type, NY); same locality, 9 July 1896, *Earle & Underwood* (NY).

This fungus bears some resemblance to *Hysterostomella* or *Palawania* in the Pleosporales. However, species of these genera are superficial on the host and their wall cells are arranged in radiating rows. The locules in *W. sabalicola* have the aspect of *Wettsteinina* as do asci and ascospores. The massive stromatic tissue which connects and surrounds ascocarps distinguishes this species from others of *Wettsteinina.*

The character which led Earle to describe *W. sabalicola* as a species of *Gnomonia* was the presence of elongate "beaks" on the surface of the leaf blotches. These structures are slender superficial outgrowths up to 1 mm long. They have no canal and are not connected with the locules in any fashion other than chance occurrence on some blotches.

Wettsteinina anomala (Ell. & Ev.) Barr, comb. nov. Figure 21.

≡ *Leptosphaeria anomala* Ell. & Ev. J. Mycol. 3: 117. 1887.
≡ *Didymosphaeria anomala* (Ell. & Ev.) Sacc. Syll. Fungorum 9: 730. 1891.
≡ *Microthelia anomala* (Ell. & Ev.) Kuntze, Rev. Gen. Pl. 3(2): 498. 1898.
= *Eriosphaeria herbarum* Wehm. Sydowia 6: 419. 1952.
= *Eriosphaeria macrospora* Wehm. Sydowia 6: 420. 1952.
≡ *Wettsteinina macrospora* (Wehm.) Petrak, Sydowia 11: 341. 1958 ["1957"].

Ascocarps 250–380 μ diam, globose, conic, or depressed, erumpent, scattered thickly on stalks; wall thick, of coarse brown or reddish-brown polygonal cells and inner hyaline compressed layers, with numerous brown hyphal appendages arising from upper wall; trailing or erect hyphae from the lower portion of the wall forming a tomentose base; ascocarp apex short papillate, the pore small. Asci 90–225 × (15–)22–53 μ, broadly oblong or clavate, occasionally 16-spored. Ascospores (23–)30–54 × (7.5–)9–14.5 μ, hyaline or yellowish, at times light dull brown, elliptic to obovate, straight to inequilateral or curved; primary septum nearly median, a ring-like constriction formed in each cell and the spores finally 3-septate, constricted at all septa; wall smooth, the gelatinous coating 2.5–5.5 μ thick.

On overwintered dicotyledonous herbaceous stalks, western North America.

Material examined:

British Columbia: *Barr 414* on *Pedicularis* sp. (UBC). Utah; Utah Territory, June 1887, *S. J. Harkness* on herbaceous stems (holotype of *Leptosphaeria anomala,* NY). Washington: *Simmons 1746* on composite stems (holotype of *E. macrospora,* MICH); *Simmons 2353* on stems (holotype of *E. herbarum,* MICH).

The specimen of *E. macrospora* has the largest ascospores of the collections grouped as *W. anomala.* These ascospores tend to be straight rather than curved, but immature ones are inequilateral and have the size range of the other collections. Petrak (1958a) considered *E. herbarum* (as "*E. herbacea*") as a form of *W. macrospora* with 16-spored asci. The type collection of *L. anomala* provided only one-septate, even rarely one-celled ascospores, identical with immature ascospores of the other collections. The heavy tomentum surrounding ascocarps is characteristic of all collections. Müller and von Arx (1950) illustrated this species as *Didymosphaeria* and observed that it was related to *Wettsteinina.*

3. Series of *W. macrotheca*: Ascocarps globose to conic, the apex short and broad papillate; ascospores oblong, the mid cells shorter than the end cells.

Wettsteinina macrotheca (Rostr.) Müller, Sydowia 12: 203. 1959 ["1958"]. Figure 22.

≡ *Metasphaeria macrotheca* Rostr. Meddel. Grønland 3: 561. 1888.
≡ *Massaria macrotheca* (Rostr.) Lind, Skrifter om Svalbard og Ishavet 13: 31. 1928.
≡ *Leptosphaeria macrotheca* (Rostr.) Holm, Svensk Bot. Tidskr. 46: 38. 1952.

Ascocarps 130–310 μ diam, globose, depressed, or conic; wall light brown, often tomentose with hyphae. Asci 90–158 × 25–36 μ, broadly clavate or saccate. Ascospores (24–)32–37(–48) × 7.5–13.5(–15) μ, hyaline, dull brownish in age, oblong or nearly so, 1–3-septate, the mid cells shorter than the end cells.

On culms and leaves of Cyperaceae, North America, Europe, Asia.

Material examined:

Northwest Territories: *Savile 3738A* (DAOM). Newfoundland: south of McClellan Strait, 17 July 1955, *Wilce* (DAOM, MASS). Quebec: *Barr 1956* (DAOM, MASS). British Columbia: *Barr 138* (UBC).

The species appears to be circumpolar on members of the Cyperaceae, particularly *Carex* spp. Müller (1959a) recorded it from the Swiss Alps, and I found it in the southern coastal mountains of British Columbia (Barr 1953).

Wettsteinina gentianae (Wehm.) Barr, comb. nov.

≡ *Sphaerulina gentianae* Wehm. Mycologia 38: 166. 1946.

Ascocarps 400–500 μ diam, globose to conic, immersed, soon erumpent, scattered, the apex short papillate; wall thick, blackish brown. Asci 150–270 × 32–54 μ, broadly oblong, few to numerous. Ascospores 45–54 × 14–18 μ, hyaline becoming dull grayish brown at maturity, elliptic-oblong, 3-septate, constricted at the septa, the mid cells shorter than the end cells; wall smooth, the gelatinous coating 4.5–6 μ thick.

On leaves and stalks of *Gentiana calycosa* Griseb., western North America.

Material examined:

British Columbia: *Barr 388* (UBC). Wyoming: Overlook, Skyline Trail, Teton Nat. Park, Moran, 5 Aug 1940, *Wehmeyer* (paratype of *S. gentianae,* MICH).

In sections of mature ascocarps the interthecial tissue is scarcely recognizable, for the asci are quite numerous and stand closely together. Above the asci remnants of interthecial tissue are present, and younger material does show asci arising in this tissue. In both *W. gentianae* and *W. macrotheca* the globules in the cells of the ascospores are lenticular, not globose. The lenticular type of globule is found in a number of species in *Lophiostoma* and *Massaria*, for example, in the Pleosporales.

Pyrenophora Fr. Summa Veget. Scand. 397. 1849.

= *Macrospora* Fuckel, Symb. Mycol. 139. 1870.
= *Polytrichia* Sacc. Syll. Fungorum 1: 451. 1882.
= *Neilreichina* O. Kuntze, Rev. Gen. Pl. 2: 862. 1891.

Ascocarps immersed to erumpent, relatively large, depressed globose; wall usually composed of sclerotial cells, forming *textura angularis*; surface bearing septate setae and/or conidiophores. Asci few in interthecial tissues, saccate or clavate, bitunicate, at times with a refractive ring surrounding protruding cytoplasm at apex. Ascospores crowded or biseriate in the ascus, yellowish brown, elliptic-obovate or oblong (the ends rounded), 3–6(–7–8)-septate, with vertical septum in one or more mid cells, rarely into end cells; wall smooth, usually surrounded by a thick gelatinous coating.

Conidial state: *Drechslera* Ito. For details of the porospores and illustrations of a number of species see Shoemaker (1962).

Saprobic on leaves and culms of monocotyledons; widespread in subarctic and temperate Europe and North America.

Macrospora Fuckel was typified by "*Sphaeria scirpi* Fr.," later corrected to *S. scirpicola* DC. ex Fr. Wehmeyer (1961) was unable to locate a De Candolle specimen of the species, and found only a species of *Leptosphaeria* on the specimen cited by Fries (1823). Wehmeyer utilized *Sphaeria scirpi* Rabenh. as the earliest name for the fungus. Fuckel's (1870) concept is identical with that of Rabenhorst according to Wehmeyer, so *Macrospora* must be relegated to synonymy with *Pyrenophora.*

The generic names *Polytrichia* and *Neilreichina* were based on *Sphaeria polytricha* Wallr. which is a species of *Pyrenophora. Pleospora* subgenus *Scleroplea* Sacc. (Syll. Fungorum 2: 277. 1883) has been considered a synonym of *Pyrenophora.* Included in this subgenus were *P. nuda* (Cooke) Sacc. & Syd. which is synonymous with *Pleospora scrophulariae* according to Wehmeyer (1961), and *P. sclerotioides* (Speg.) Sacc. & Syd. and *P. trochila* (Fr.) Sacc. & Syd., both of which Wehmeyer listed as doubtful species. Von Höhnel (1907b) emended the concept of *Scleroplea* (Sacc.) Oud. (Kon. Akad. Amsterdam 9: 152. 1900) and distinguished it from *Pyrenophora* by the absence of setae on the ascocarps. This characteristic is not sufficient to delimit genera.

The history of the genus *Pyrenophora* Fries was reviewed by Shoemaker (1961), who concluded that the genus was distinct from *Pleospora.* Wehmeyer, also in 1961, accepted *Pyrenophora* Fuckel non Fries, with type species *P. phaeocomes,* although earlier (1953) he had proposed that the species of *Pyrenophora* be included in *Pleospora.* According to Wehmeyer's (1954) developmental study of *Pleospora trichostoma* which belongs to *Pyrenophora,* and to Müller's (1951b) figure of a section through an ascocarp of *P. phaeocomes,* it is evident that locule development is of the *Pseudosphaeria* rather than the *Pleospora* developmental type. For this reason *Pyrenophora* is arranged in the Pseudosphaeriaceae. Von Höhnel (1907b) had already come to this conclusion after studying *P. phaeocomes* and *P. trichostoma,* when he included *Pyrenophora* in his enlarged concept of the Pseudosphaeriaceae. Thiessen (1916) accepted von Höhnel's disposition of *Pyrenophora.*

Type species: *P. phaeocomes* (Reb. ex Fr.) Fries.

Pyrenophora phaeocomes (Reb. ex Fr.) Fr. Summa Veget. Scand. 397. 1849.

Ascocarps 300–600 μ diam, depressed globose; wall sclerotial and thick, setose on upper surface. Asci 200–450 × 20–80 μ. Ascospores 55–100 × 25–40 μ, yellowish brown or dull brown, 6 (–7)-septate; primary septum supramedian, with vertical septum in all cells.

Conidial state: *Drechslera.*

On *Holcus* spp., Europe.

Wehmeyer (1961) provided additional details of synonymy for this fungus which has not yet been recognized in North America. The large ascospores with vertical septum through all cells are distinctive.

Additional species:

Pyrenophora schroeteri Barr, nom. nov. Figure 26.

≡ *Pleospora macrospora* Schroet. Jahresb. Schles. Ges. Vaterl. Cult. 58: 176. 1881; Hedwigia 21: 153. 1882, *non* Fuckel, Symb. Mycol. 138. 1870, nec de Not. Mém. Acad. Sci. Turin 7, nomen nudum. 1842, Ces. & de Not. Comm. Soc. Critt. Ital. 1: 218. 1863.
≡ *Clathrospora macrospora* (Schroet.) Nannf. Mitt. Bot. Inst. TH. Wien 8: 30. 1931.
≡ *Pyrenophora macrospora* (Schroet.) Wehm. World Monog. Genus *Pleospora* 278. 1961.

Ascocarps 250–300 μ diam, globose, the apex short papillate; wall of sclerotial cells, these 20–24 μ thick externally; inner layers of thin walled cells, light yellowish brown, ca. 24 μ thick. Asci 125–165 × 33–40 μ, broad clavate, with refractive ring around protruding cytoplasm in apex. Ascospores 35–42 × (12–)15–18(–21) μ, yellowish brown, broadly elliptic, 3-septate, not or slightly constricted at septa, with vertical septum in one or both mid cells; thin gelatinous coating present at times.

On culms of Gramineae, Europe, North America.

Material examined:

Northwest Territories: *Bartlett 2950* (MICH). British Columbia: *Barr 464* (UBC). Ontario: *Ell. & Ev. N.A.F. 3118.*

Pyrenophora schroeteri has 3-septate ascospores much like those of *P. trichostoma,* but they are usually paler in color and thinner walled in the former. The ascocarps of *P. schroeteri* are smaller and have a thinner wall than those of *P. trichostoma.*

Pyrenophora scirpi (Rabenh.) Wehm. World Monog. Genus *Pleospora* 287. 1961. Figures 23–25.

≡ *Sphaeria scirpi* Rabenh. Herb. Mycol. Europ. n. 456. 1837.
≡ *Pleospora scirpi* (Rabenh.) Ces. & de Not. Comment. Soc. Critt. Ital. 1: 217. 1863.
= *Pleospora aquatica* Griffiths, Bull. Torrey Bot. Club 26: 443. 1899.

Ascocarps 100–250 μ diam, globose or depressed; wall relatively thin, 16–20 μ thick, the surface glabrous or nearly so. Asci 77–120 × 24–30 μ, broadly clavate. Ascospores 25–31(–54) × 10–13(–20) × 9–11(–12.5) μ, yellowish brown, obovate, somewhat compressed and elliptic in side view, 5-septate, with vertical septum in one or all mid cells.

On *Eleocharis* and *Scirpus,* Europe, North America.

Material examined:

South Dakota: *Griffiths West Amer. Fungi 11* on *Eleocharis palustris* (L.) R. & S. (isotype of *Pleospora aquatica*).

Wehmeyer (1961) discussed this species and provided several additional synonyms for it. The measurements of ascospores for Griffiths' material range smaller than do those for European specimens. In the description above, the ascospore sizes in parentheses are the upper end of the size range reported by Wehmeyer from European collections. Five-septate ascospores are found in both *P. scirpi* and *P. polytricha.* Ascocarps distinguish the two species: those of *P. polytricha* are 400–600 μ diameter and have a thick sclerotial wall.

Wehmeyer (1961) treated several other species within the genus, including *P. trichostoma.* Shoemaker (1962) considered that several species which could be distinguished by their conidial states had been merged under *P. trichostoma* by Wehmeyer.

Dermatina Almq. Kongl. Svenska Vetenskapsakad. Handl. 17(6): 8. 1880.

= *Mycoporum* Flotow in Körob. Grunds. Kräuterk. 199. 1848, *non Mycoporum* Mey. 1825 (synonym of *Melanotheca*).

Ascocarps aggregated, usually multiloculate, depressed globose or irregular, superficial with bases embedded in thin crustose thallus composed of sloughed periderm cells, fungal hyphae and algal cells (*Palmella* sec. Fink 1935; *Trentepohlia* sec. Kreisel 1969); ascocarp wall of several layers of polygonal brown cells, forming *textura angularis,* narrowed at base; apical pore rounded and indistinct. Asci ovate or saccate, few in interthecial tissue, bitunicate, sessile. Ascospores crowded in the ascus, obovate or elliptic, hyaline becoming dull brown, straight to inequilateral, several-septate, constricted at primary septum, with one vertical septum through all cells; contents homogenous or minutely guttulate; wall smooth, surrounded by gelatinous coating.

On bark of trees, widespread and probably cosmopolitan in temperate regions.

In lichen classification, *Dermatina* is a genus of the Mycoporaceae. The family was placed in the Dothideales by Clements and Shear (1931) and in the Pleosporales by Hale (1961), but most authors have kept lichenized separate from non-lichenized genera. The type species of *Dermatina* produces ascocarps in which the asci are separated by interthecial tissue. The aspect is of the *Pseudosphaeria* type of development. Other genera placed in the family according to Riedl's recent revisionary studies (1962, 1963, 1964) seem to include both *Dothidea* and *Pleospora* types of development. None of the other representatives of genera in Mycoporaceae which I have studied have a similar developmental type to *Dermatina.* They must be treated within the framework of the Pleosporales.

Type species: *D. elabens* (Schaer.) A. Zahlbr.

Dermatina elabens (Schaer.) A. Zahlbr. Cat. Lichen. Univ. 1: 548. 1922. Figures 27–29.

≡ *Lecidea elabens* Schaer. Lichen. Helv. Spicil. 199. 1833.
≡ *Mycoporum elabens* (Schaer.) Flot. in Nyl. Actes Soc. Linn. Bordeaux 21: 417. 1856.
≡ *Arthonia elabens* (Schaer.) Boist. Nouv. Flore Lichen. 2: 256. 1903.
= *Arthothelium flotowianum* Körb. Parerg. Lichen. 261. 1861.
≡ *Dermatina flotowianum* (Körb.) Arnold, Flora 64: 204. 1881.
≡ *Curreya* (*Curreyella*) *flotowianum* (Körb.) v.Höhnel, Sitzungsber. Kaiserl. Akad. Wiss. Math.-Naturwiss. Kl. 118: 74. 1909.

Thallus thin, forming a dull yellowish crust on surface of bark; ascocarps black, depressed globose to irregular, 550–1000 μ diam, 350–385 μ high; locules poorly defined, composed of small groups of asci in interthecial tissue, the groups separated by hyaline cells. Asci 60–95 × 22–35 μ, saccate. Ascospores 24–28 × 9–11 μ, hyaline becoming dull brown, obovate or elliptic, 7-septate, constricted at primary septum, with vertical septum extending through all cells, often oblique in end cells; contents minutely guttulate; gelatinous coating present.

On bark of trees, Europe.

Material examined:

Switzerland: circa Wachseldorn, *Schaerer 232* (MASS).

The synonymy was provided by Riedl (1964).

Additional species:

Dermatina pyrenocarpa (Nyl.) Zahlbr. in Engler & Prantl, Natürl. Pflanzenfam. 2 Aufl. 8: 93. 1926. Figures 30–31.

≡ *Mycoporum pyrenocarpum* Nyl. Flora 41: 381. 1858.

Thallus crustose, thin, grayish; ascocarps black, depressed globose to irregular, separate or multiloculate, (250–)770–1000 μ diam, 165–250 μ high; locules small, 150–200 μ diam, separated by hyaline or brown cells. Asci 75–80 × 35–40 μ, saccate, few in locule. Ascospores 30–40 × 10–12 μ, hyaline, light dull brown in age, elliptic to obovate (lower end pointed at times), 3–7-septate, constricted at primary septum, with one vertical septum through all or most cells; thin gelatinous coating surrounding ascospores.

On bark of trees, North America.

Material examined:

Massachusetts: Spencer, 1884, *G. E. Stone* (MASS).

The larger ascospores and dull colored thallus separate this species from *Dermatina elabens.*

Dothioraceae Theiss. & Sydow, Ann. Mycol. 15: 444. 1917.

≡ *Botryosphaeriaceae* Theiss. & Sydow, Ann. Mycol. 16: 16. 1918; Müller & von Arx, Ber. Schweiz. Bot. Ges. 60: 389. 1950.

Ascocarps pulvinate, globose, depressed, or conic, uni- or multiloculate, opening at maturity by a large irregular area or broadly rounded pore; wall thick, of large cells, blackened externally, forming *textura angularis,* often vertically oriented in rows; locule in early stages filled with vertically oriented rows of hyaline cells. Asci clavate with foot-like base, tapered to a short or long stipe, bitunicate, octo- or polysporous, arising from a thick basal layer or modified cone or column of hyaline cells, growing into locule tissue and compressing this, appearing aparaphysate at maturity. Ascospores overlapping biseriate or crowded in the ascus, hyaline, yellowish, or light brown, rarely dark brown, obovate or elliptic, often tapering to base, one-celled or one- to several-septate, at times with vertical septum in one or more cells; contents minutely guttulate or granular; wall smooth, at times surrounded by a gelatinous coating.

Conidial state where known: *Dothichiza, Dothiorella, Botryodiplodia, Phyllostictina, Macrophoma, Hadrotrichum, Dothistroma.*

On living or dead woody branches or leaves of gymnosperms and angiosperms, occasionally on culms of monocotyledons, cosmopolitan.

Theissen and Sydow (1917) arranged the genera *Bagnisiella, Yoshinagaia, Wettsteinina, Pseudosphaeria,* and *Dothiora* in their family 6. Dothioraceae of the Myriangiales. Previously (1915) they included these and other genera in an "Anhang" to their arrangement of the Dothideales. Of the genera listed above, *Yoshinagaia* P. Henn. is extralimital and the remainder are included in the present treatment of this family or of the Pseudosphaeriaceae. Müller and von Arx (1950) discussed the *Dothiora* line of development and provided the ordinal name Dothiorales to include the Botryosphaeriaceae, Dothioraceae, Hysteriaceae, and Phacidiaceae. Representatives of the latter two families differ from those of the Botryosphaeriaceae and Dothioraceae and by 1954 Müller and von Arx had separated the Phacidiaceae into the Phacidiales. Müller and von Arx included species with one-celled ascospores in the Botryosphaeriaceae and species with septate ascospores in the Dothioraceae (von Arx and Müller 1954, Müller and von Arx 1962). Luttrell (1951b) included the Dothioraceae in the Pseudosphaeriales, as had Nannfeldt (1932) and others, but by 1955 Luttrell recognized that members of the Dothioraceae exhibited the *Dothidea* developmental type and transferred the family to the Dothideales.

Key to Genera

1. Ascospores one-celled; asci octosporous.
   2. Ascocarps pulvinate, single broad locule in upper portion. *Bagnisiella.*
   2. Ascocarps depressed globose or conic, uni- or multi-loculate. *Botryosphaeria.*
1. Ascospores one- to several-septate; asci octo- or poly-sporous.
   3. Ascospores one-septate (occasionally becoming two-septate).
      4. Asci polysporous. *Delphinella.*
      4. Asci octosporous.
         5. Ascocarps uni- or multiloculate, globose or elongate, immersed or erumpent. *Scirrhia.*
         5. Ascocarps multiloculate, peltate, superficial on erumpent foot-like hypostroma. *Coccoidella.*
   3. Ascospores several-septate; vertical septum sometimes formed.
      6. Asci polysporous. *Sydowia.*
      6. Asci octosporous.
         7. Ascocarps medium to large, uni- or multiloculate, depressed pulvinate or elongate; asci arising from plane base of locule or from low cushion of hyaline cells. *Dothiora.*
         7. Ascocarps small, uniloculate, globose; asci arising from central conic protrusion or column of hyaline cells in base of locule. *Saccothecium.*

Bagnisiella Speg. Fungi Argent. 3: 22. 1880.

Ascocarps pulvinate, immersed in periderm, soon erumpent, scattered or grouped; apex plane or depressed, opening widely and irregularly at maturity; wall of sclerotial or thin-walled cells, large, forming *textura angularis,* arranged in upright rows, blackened externally, brownish to hyaline within; locule in upper portion, broad, when immature composed of hyaline, thin-walled cells. Asci clavate oblong, bitunicate, octosporous, parallel, arising from base of locule into cells which become compressed or dissolved. Ascospores overlapping bi- to triseriate in the ascus, hyaline, narrowly elliptic, tapered to pointed ends, one-celled, straight to inequilateral; contents minutely guttulate; wall smooth.

Conidial state not known.

On woody branches, cosmopolitan.

Bagnisiella is a taxon which could be interpreted as an advanced member of the Myriangiales, or as a genus of the Pseudosphaeriaceae, with remnants of locule cells persisting at times between as well as above the asci. The pulvinate ascocarps and parallel asci are typical of the family Dothioraceae, however, and *Bagnisiella* is considered a primitive member of this family.

The genus *Columnosphaeria* Munk (1953) has ascospores similar to those of *Bagnisiella,* but the asci arise from a basal column of cells as do those of *Saccothecium* and also *Phyllachorella.* Although von Arx and Müller (1954) treated Munk's genus as a synonym of *Guignardia* and the type species as a synonym of *G. cytisi* (Fuckel) v. Arx & Müller, Munk (1957) reiterated his belief in the position of *Columnosphaeria* as a genus parallel to *Saccothecium* (sub *Pringsheimia*) and closely related to *Botryosphaeria* in ascospore characteristics.

Type species: *B. australis* Speg.

Bagnisiella australis Speg. Fungi Argent. 3: 22. 1880. Figures 32–34.

Ascocarps 550–1100 μ diam, 275–550 μ high, or larger and irregular in shape if closely grouped and connected, pulvinate; wall of thin or thick walled cells; locule occupying upper third of stroma beneath outer blackened wall layers. Asci 60–90 × 16–27 μ. Ascospores 22–33 × 6–8 μ.

On woody branches, cosmopolitan.

Material examined:

Kansas: Concordia, 20 Apr 1907, on *Morus, Bartholomew* (BPI). Texas: Del Rio, 13 Mar 1903, on *Prosopis, C. L. Shear* (BPI).

Both of these collections were determined by Dr. F. Petrak. They agree with the description of *Bagnisiella australis* from Argentina on *Acacia* branches.

Another North American species which has been included in the genus is *B. arctostaphyli* (Plowr.) Theiss. Ann. Mycol. 14: 332. 1916. A specimen in NY from Yosemite Valley, California, *Harkness 3528,* does not have ascigerous locules. The ascocarps are similar in appearance and structure to those of *B. australis,* although smaller; the locule is occupied by numerous hyaline conidia of the *Dothichiza* type. Ellis and Everhart (1892) noted that only "spermogonia" were present on the specimens they examined.

Botryosphaeria Ces. & de Not. Comment. Soc. Critt. Ital. 1: 211. 1863; emend. Sacc. Michelia 1: 42. 1877, Syll. Fungorum 1: 456. 1882.

Von Arx and Müller (1954) synonymized a number of genera under *Botryosphaeria;* repetition of their listing is avoided here. The following synonym was added by Petrak (1958b):

= *Guignardia* Viala & Ravaz, Bull. Soc. Mycol. France. 9: 63. 1892.

Ascocarps immersed to erumpent, depressed globose to conic, uni- or multiloculate, scattered to grouped, medium or large; apex rounded or papillate, opening widely at maturity; wall thick, several layers of cells forming *textura angularis* or *textura globosa,* the outer layers blackened and thick walled; inner layers of hyaline to yellowish small polygonal cells, forming a broad basal cushion and lining sides of locule and filling apical pore region until maturity. Asci clavate or oblong, stipitate or sessile, arising from broad base of locule into and dissolving locule cells. Ascospores hyaline or yellowish, becoming brown at times, elliptic, obovate or obtrullate at times, one-celled, often inequilateral; contents granular or minutely guttulate; wall smooth, at times surrounded by gelatinous coating or appendage(s) at one or both ends.

Conidial states: Pycnidia uni- or multiloculate, the wall relatively thick; conidiophores short and indistinct, lining locule; conidia hyaline or brown, one-celled or one-septate. Described as: 1) *Dothiorella,* conidia one-celled, hyaline, fusoid. The *Dothiorella* state of *Botryosphaeria dothidea* is illustrated by Shoemaker (1964) and von Arx (1970). 2) *Phyllostictina,* conidia one-celled, hyaline, oblong, often with gelatinous appendages. The *Phyllostictina* state of *B. philoprina* is illustrated by von Arx (1970). 3) *Botryodiplodia,* conidia one-celled or septate, becoming brown, oblong (illustrated by Shoemaker 1964). Also conidial states are described under *Macrophoma* and *Lasiodiplodia.*

On woody branches or leaves of gymnosperms and angiosperms, culms of monocotyledons, herbaceous stalks or leaves of dicotyledons; cosmopolitan.

Von Arx and Müller (1954) regarded both *Botryosphaeria* and *Guignardia* as genera of the family Botryosphaeriaceae. They separated *Botryosphaeria* from *Guignardia* particularly on the basis of larger sizes in *Botryosphaeria,* and designated certain species as intermediate between the two genera because of intermediate size. *Guignardia* was established by Viala and Ravaz (1892) to replace *Laestadia* Auersw. 1869, predated by *Laestadia* Lessing 1832 (a genus of Compositae). However, Viala and Ravaz did not realize that the type species, *Laestadia alnea* (Fr.) Auersw. differed generically from *Guignardia bidwellii* (Ellis) Viala and Ravaz, the species they discussed at that time. Von Höhnel (1918) noted the differences and transferred *L. alnea* to *Gnomonina.* He concluded that *Guignardia* in the sense of *G. bidwellii* was identical with *Phyllachorella* Syd. Sydow (1919) correctly showed that *Guignardia* was a replacement for *Laestadia* Auersw. so that *L. alnea* must be retained as the type of *Guignardia* and *Gnomonina* v.Höhnel become a synonym of *Guignardia.* The majority of workers, from Schroeter (1894) and Lindau (1897) to the present time, have accepted *Guignardia* as the name for a number of small species with one-celled ascospores. Unfortunately, both bitunicate and unitunicate ascus types were involved.

While the delimitation of *Guignardia* in the sense of *G. bidwellii* by von Arx and Müller (1954) resulted in a more closely related group of species, problems still occurred in distinguishing between small species of *Botryosphaeria* and large species of *"Guignardia."* Consequently, the genera could not be clearly defined. Petrak (1958b, 1968) proposed that *Botryosphaeria* include those species of *"Guignardia"* in which the asci pushed irregularly (not all developing at the same time) into the locule tissue which finally became compressed between the asci. These species included *G. bidwellii,* as well as those species which were intermediate between *Botryosphaeria* and *"Guignardia"* in von Arx and Müller's (1954) interpretation. As an additional characteristic uniting all the species of *Botryosphaeria,* Petrak utilized the conidial states. Petrak recognized four divisions of *Botryosphaeria* in his study: 1) species with well-developed prosenchymatic stroma, large locules, large ascospores, on woody branches; 2) species with well-developed or slight pseudo- or prosenchymatic stroma, medium to large locules, medium-sized ascospores, on woody branches; 3) species without stroma, perithecium-like, medium to large locules, medium to large ascospores, on grasses, or herbaceous stalks, rarely leaves; and 4) species without stroma, medium to small perithecium-like locules, medium to small ascospores, mostly on leaves. The fourth group of species he typified by *B. bidwellii* and in it he included several of the difficult "intermediates" between *Botryosphaeria* and *"Guignardia."* The remaining species of *"Guignardia,"* which Petrak noted had a different development—the asci developing at almost the same time and locule tissue disintegrating early—could be accommodated in the genus *Discosphaerina* in the Dothideaceae.

Originally I had recognized *Botryosphaeria* and *Guignardia* as amerosporous representatives of the families Dothioraceae and Dothideaceae respectively. The species of *"Guignardia"* fell into two groups: the *G. bidwellii* group with relatively thick walled, usually globose to conic ascocarps, and relatively few asci, and the *G. discophora* group with thin walled ascocarps, depressed globose, and relatively numerous asci. By transferring the *G. bidwellii* group to *Botryosphaeria* where they appear to belong, and by recognizing *Discosphaerina* for the species typified by *D. discophora,* clear demarcation of the genera can be provided. The conidial states are also different. Pycnidia of species of *Botryosphaeria* have a large-celled wall much like that of the perfect state. In *Discosphaerina* the conidial state is produced in pycnidia with a thin wall of small lighter colored cells.

The extralimital *Phyllachorella* Sydow with the type species *P. micheliae* Sydow belongs in the Dothioraceae and is closely related to *Botryosphaeria.* Multiloculate ascocarps are parasitic on living leaves of *Michelia* species. The dome-shaped basal cushion from which the asci arise provides generic distinction. The aspect is similar to that in *Saccothecium. Phyllachorella* bears much the same relationship to *Botryosphaeria* as does *Saccothecium* to *Dothiora* or *Columnosphaeria* to *Bagnisiella.*

In North America the species of *Botryosphaeria* may be grouped much as in Petrak's (1958b) interpretation, although I combine his first two groups and divide the genus into three sections.

Key to Sections

1. Fungi on woody dicotyledon branches; ascocarps multi- or uniloculate and connected by hyphae; ascospores medium-sized to large. Section *Botryosphaeria.*
1. Fungi on gymnosperms, monocotyledons, or herbaceous dicotyledons; ascocarps usually uniloculate.
   2. On gymnosperms or monocotyledons; ascospores medium-sized to large. Section *Pyreniella.*
   2. On herbaceous dicotyledons; ascospores small to medium-sized. Section *Discochora.*

Botryosphaeria section **Botryosphaeria.**

Lectotype species: *B. dothidea* (Moug. ex Fr.) Ces. & de Not.

Several different species have been chosen as lectotype of the generic name. Cesati and de Notaris included fourteen species in the original delimitation of *Botryosphaeria.* The first species was *B. pulicaris* which is *Gibberella pulicaris.* Theissen and Sydow (1915) suggested that *B. quercuum* (Schw.) Sacc. be chosen as lectotype, since it was typical of Saccardo's emendation of *Botryosphaeria.* Von Arx and Müller (1954) accepted *B. quercuum* as the type species. This was not one of the original species of the genus. Von Höhnel (1909) designated *B. beringeriana* de Not. as type, but de Notaris published that species some years after the genus was proposed. It is now considered to be synonymous with *B. dothidea* (von Arx and Müller 1954). Because *B. dothidea* was one of the original species of the genus and also conforms to Saccardo's emended description, I propose this species as lectotype of *Botryosphaeria.*

Botryosphaeria dothidea (Moug. ex Fr.) Ces. & de Not. Comment. Soc. Critt. Ital. 1: 212. 1863. Figures 35–37.

For a number of synonymous names, see von Arx and Müller (1954).

Ascocarps 200–250 μ diam, 150–200 μ high, globose depressed, thickly grouped and at times connected; wall 27–39 μ thick. Asci 55–75 × 13–18.5 μ. Ascospores (12–)15–24 × (5.5–)6–10 μ, elliptic to obovate, apex obtuse, base pointed; gelatinous coating sometimes surrounding spores.

Conidia 12–30 × 4–8(–10) μ, hyaline, fusoid, one-celled.

On branches of woody plants, cosmopolitan.

Material examined:

Massachusetts: *Guba, Nantucket Fungi 88* (as *Sphaeropsis malorum,* MASS). New York: *Fungi Columbiani 3407, 3408, 3409* (as *B. ribis*) Michigan: *Barr 1462* (MASS). North Carolina: Raleigh, March 1924, *F. A. Wolf* (on type of *Sphaerulina polyspora* Wolf, BPI). Alabama: *Alabama Fungi 8, R. P. Burke* (NY).

Additional species:

Botryosphaeria quercuum (Schw.) Sacc. Syll. Fungorum 1: 456. 1882. Figure 38.

Von Arx and Müller (1954) examined many collections and provided a long synonymy for this species. Add to synonymy:

= *Sphaeria eunotiaespora* Cooke & Harkness, Grevillea 13: 18. 1884.
≡ *Wallrothiella eunotiaespora* (Cooke & Hark.) Berl. & Vogl. Addit. Syll. Fungorum 68. 1886.

Ascocarps usually multiloculate, 250–450 μ diam, 250–400 μ high; wall thick especially over apex, 50–60(–100) μ thick. Asci 100–110 ×21–25 μ. Ascospores (26–)30–36 × (10–)12–16 μ, hyaline to yellowish, elliptic, the ends obtuse.

Conidia (18)–21–25 × (10–)14–17 μ, hyaline, one-celled.

On branches of woody dicotyledons, cosmopolitan.

Material examined:

New York: *Ascomycetes and Lower Fungi 51; New York Fungi 373; Ell. & Ev. N.A.F. 3264* (as *Dothiorella quercina*). New Jersey: Malaga, 22 Sept 1878, *Ellis* (as *Dothidea moricola,* NY). North Carolina: *Ravenel Fungi Car. 62* (as *Sphaeria mutila*), *58* (as *Sphaeria quercuum*). California: San Francisco, Feb 1881 (type of *Sphaeria eunotiaespora,* CAS).

Botryosphaeria obtusa (Schw.) Shoemaker, Canad. J. Bot. 42: 1298. 1964.

≡ *Sphaeria obtusa* Schw. Trans. Amer. Philos. Soc. II. 4: 220. 1832.
= *Physalospora corni* Ell. & Ev. Proc. Acad. Nat. Sci. Philadelphia 47: 427. 1896, *non P. corni* Sacc.
≡ *Physalospora everhartii* Sacc. & Sydow, Syll. Fungorum 14: 521. 1899.

Ascocarps usually uniloculate, 210–280 μ diam, 140–175 μ high, depressed globose. Asci 63–120 × 16–25 μ. Ascospores 22–27(–32) × 6.5–12 μ, hyaline to yellowish, elliptic or obovate, the ends obtuse or pointed.

Conidia (14–)20–28 × (7–)10–12(–16) μ, brown, 1-celled or 1-septate.

On woody dicotyledons, North America.

Material examined:

Ontario: *Fungi Columbiani 4704* (as *B. hamamelidis*). Massachusetts: West Deerfield, 4 Mar 1970, *Ahles* (MASS). New York: Hyde Park, 25 Feb 1968, *Ahles* (MASS). Colorado: *Ell. & Ev. N.A.F. 3322* (as *Physalospora corni*). Missouri: *Fungi Columbiani 2609* (as *B. delilei*).

The conidial state has been issued in a number of exsiccati: *Fungi Columbiani 2483* and *Ell. & Ev. N.A.F. 3550* as *Sphaeropsis mali; Economic Fungi 421* as *S. malorum; Ell. & Ev. N.A.F. 3549* as *S. juglandis.*

Botryosphaeria melanops (Tul.) Winter in Rabenh. Kryptogamenfl. 1(2): 800. 1887.

For synonymy of this species and a discussion of its distinguishing characteristics see Shoemaker (1964). The ascospores measure (31–)34–36(–49) × (14–)16–18(–21) μ and the hyaline conidia (41–)47–50(–53) × (9–)10–11 μ. The fungus is apparently cosmopolitan on branches of *Quercus.*

Botryosphaeria section **Pyreniella** (Theiss.) Barr, comb. nov.

≡ *Pyreniella* Theiss. Verh. Zool.-Bot. Ges. Wien 66: 371. 1916.

Type species: *B. festucae* (Lib.) v. Arx & Müller.

Botryosphaeria festucae (Lib.) v.Arx & Müller, Beitr. Kryptogamenfl. Schweiz 11(1): 38. 1954.

For a number of synonymous names see von Arx and Müller (1954). Add to synonymy:

= *Dothidea dasylirii* Peck, Bot. Gaz. 7: 57. 1882.
≡ *Phyllachora dasylirii* (Peck) Sacc. Syll. Fungorum 2: 606. 1883.
≡ *Botryosphaeria dasylirii* (Peck) Theiss. & Syd. Ann. Mycol. 13: 663. 1915.

Ascocarps 300–450 μ diam, globose or somewhat depressed, uni- or few-loculate, usually with conspicuous papillate apex; wall thick, 40–60 μ thick. Asci 85–110 × 20–28 μ. Ascospores 22–35 × 7.5–15 μ, hyaline to yellowish, elliptic, often tapered to pointed base; cap-like gelatinous coating present over basal end at times.

On leaves or culms of large monocotyledons, Europe, North America.

Material examined:

Alaska: Atak, 2 Aug 1948, *Bank* (MICH). Louisiana: St. Martinsville, 20 Oct 1888, *Langlois* (type of *Physalospora conica,* NY). Arizona: May 1881, *Pringle* (type of *Dothidea dasylirii,* NYS).

Von Arx and Müller (1954) synonymized *Dothidea dasylirii* under *B. quercuum.* However, the host plant and slightly smaller ascospores of *D. dasylirii* suggest to me that it is better placed as a synonym of *B. festucae.*

Additional species:

Botryosphaeria abietina (Prill. & Delacr.) v. Arx & Müller, Beitr. Kryptogamenfl. Schweiz 11(1): 42. 1954.

≡ *Physalospora abietina* Prill. & Delacr. Bull. Soc. Mycol. France 6: 114. 1890.
≡ *Cryptosporina abietina* (Prill. & Delacr.) Theiss. Verh. Zool.-Bot. Ges. Wien 66: 394. 1916.

Ascocarps 245–300 μ diam, 180–280 μ high, depressed globose, scattered; wall thick, 50–90 μ thick. Asci 75–102 × 18–22.5 μ. Ascospores 18–24 × 7.5–9 μ, hyaline, elliptic to obovate, the ends obtuse or pointed.

On leaves and twigs of *Abies* spp., Europe, North America.

Material examined:

Quebec: *Barr 1936* (DAOM, MASS).

Three additional species described from conifers are included in this section. Descriptions may be found in the cited journals.

Botryosphaeria laricis (Wehm.) v.Arx & Müller, Beitr. Kryptogamenfl. Schweiz. 11(1): 42. 1954.

A recent description of this fungus and its conidial state was provided by Smerlis (1970b).

Botryosphaeria tsugae Funk, Canad. J. Bot. 42: 770. 1964.

Botryosphaeria piceae Funk, Canad. J. Bot. 43: 45. 1965.

Botryosphaeria section **Discochora** (v.Höhnel) Barr, comb. nov.

≡ *Discochora* v.Höhnel, Ber. Deutsch. Bot. Ges. 36: 315. 1918.

Type species: *B. philoprina* (Berk. & Curt.) v.Arx & Müller.

Botryosphaeria philoprina (Berk. & Curt.) v.Arx & Müller, Beitr. Kryptogamenfl. Schweiz 11(1): 40 1954.

Synonymy of this species was provided by von Arx and Müller (1954).

Ascocarps 200–230 μ diam, 120–160 μ high, depressed globose, immersed, mostly epiphyllous, thickly scattered; wall 20–24 μ thick. Asci 60–77 × 12–14.5 μ. Ascospores 12–16.5 × 4.5–6 μ, hyaline, elliptic to obtrullate, straight to inequilateral, the ends obtuse; gelatinous cap-like appendage at both ends, 1–2.5 μ high, 2.5–3.5 μ wide.

Conidial state: *Phyllostictina ilicicola* (Cooke & Ell.) v.Höhnel. *Macrophoma ilicella* (Sacc. & Penz.) Berl. & Vogl. Bonar (1934) described the results of cultural studies of the *Macrophoma* state.

On dead leaves of *Ilex* spp., Europe, Asia, North America.

Material examined:

Massachusetts: *Barr 4832* (MASS). Rhode Island: *Barr 4833* (MASS). New Jersey: *Ellis N.A.F. 196* (as *Sphaeria ilicis* Schleich.). Maryland: *Barr 4863* (MASS). North Carolina: *Ravenel, Fungi Carol. Exs. Fasc. IV, n. 63* (as *Sphaeria ilicis*).

Additional species:

Botryosphaeria bidwellii (Ell.) Petrak, Sydowia 11: 440. 1958 ["1957"]. Figures 39–41.

≡ *Sphaeria bidwellii* Ellis, Bull. Torrey Bot. Club 9: 90. 1880.
≡ *Physalospora bidwellii* (Ell.) Sacc. Syll. Fungorum 1: 441. 1882.
≡ *Laestadia bidwellii* (Ell.) Viala & Ravaz, Progr. Agric. & Vitic. 492. 1888; Ell. & Ev. North Amer. Pyrenomyc. 262. 1892.
≡ *Sphaerella bidwellii* (Ell.) Ell. Cat. Pl. New Jersey 552. 1890.
≡ *Guignardia bidwellii* (Ell.) Viala & Ravaz, Bull. Soc. Mycol. France 8: 63. 1892.
≡ *Carlia bidwellii* (Ell.) P. Magnus, Bull. Soc. Mycol. France. 9: 174. 1893; Prunet, Rev. Gen. Bot. 10: 127. 1892.
≡ *Phyllachorella bidwellii* (Ell.) Theiss. Verh. Zool.-Bot. Ges. Wien 69: 11. 1919.

Ascocarps 120–150 μ diam, globose or conic with erumpent papillate apex, thickly grouped and connected by dark brown cells which may form a crust up to 30 μ thick; wall 10–15 μ thick. Asci 50–65 × 11–14.5 μ. Ascospores 12–13.5 × 5.5–6.5 μ, hyaline, obovate or obtrullate, straight to inequilateral, the ends obtuse.

Conidial state: *Phyllostictina uvicola* (Berk. & Curt.) v.Höhnel. Conidia 5–8 × 3–4 μ, hyaline, elliptic, one-celled. Microconidial state: conidia 4–6 × 0.5 μ, hyaline, rod-shaped, one-celled.

On fruits and branches of *Vitis* spp., North America, Europe.

Material examined:

Massachusetts: *Barr 2870* (MASS); *Guba, Nantucket Fungi 148*; Jefferson, Aug 1917, *Kendall* (MASS); *Laird 10* (MASS). Florida: Gainesville, 4 Aug 1922, *Weber* (MASS).

The globose or conic widely erumpent ascocarps of this and the following species differentiate them from the remaining species in *Botryosphaeria* section *Discochora,* of which the ascocarps are depressed globose or elliptic with the apex slightly erumpent.

Additional species:

Botryosphaeria spiraeae Barr, sp. nov.

Ascocarpia 120–180 μ diametro, globoso-conica, erumpentia, aggregata cum hyphis umbrinis, peridio 16.5–20 μ crasso. Asci 46–84 × 16–24 μ, oblongi vel saccati, bitunicati. Ascosporae 15.5–24 × 6.5–9 μ, hyalinae vel raro fuscae, ellipticae vel obovatae, unicellulares.

Specimen typicum in folius emortuis *Spiraeae latifoliae,* prope "Neighborhood Trail, near Johnson, Lamoille Co., Vermont, 11 Aug 1964," legit *M. E. Barr n. 4499*; in Herb. Univ. Mass. depositum.

Ascocarps 120–180 μ diam, globose conic, widely erumpent, in small groups surrounded by dark brown hyphae and forming blotches, amphigenous; wall 16.5–20 μ thick. Asci 46–84 × 16–24 μ. Ascospores 15.5–24 × 6.5–9 μ, hyaline, occasionally dull brown in age, elliptic or obovate, straight to inequilateral, the ends obtuse.

On overwintered leaves of *Spiraea latifolia* (Ait.) Borkh., still attached to branch, northeastern North America.

Material examined:

Vermont: *Barr 4499* (type, MASS).

This is a striking fungus, forming blackened blotches up to 3 mm across on leaves. The mycelium radiates from the hyphal center which contains a few ascocarps.

Botryosphaeria diapensiae (Rehm) Barr, Mycologia 62: 384. 1970.

≡ *Physalospora diapensiae* Rehm, Ann. Mycol. 6: 323. 1908.
≡ *Guignardia diapensiae* (Rehm) v.Arx & Müller, Beitr. Kryptogamenfl. Schweiz 11(1): 55. 1954.

Ascocarps 105–120 μ diam, 75–105 μ high, depressed globose, immersed, scattered, mostly epiphyllous; wall 15–18 μ thick. Asci 30–63(–88) × 15–21 μ. Ascospores (16.5–)18–27.5 × 4–6.5 μ, hyaline to yellowish, narrowly obovate, straight to slightly curved (the ends narrowed but obtuse), at times with narrow cap-like gelatinous appendage ca. 1 μ long over basal end.

On overwintered leaves of *Diapensia lapponica* L., Europe, North America.

Material examined:

Quebec: *Brunel 150; Marie-Victorin & Rolland-Germain 25136; Boivin & Blain 644* (DAOM, MASS). New Hampshire: *Barr 4096A* (MASS). Europe: Finland: Petsovmo: Linshamari, 8 July 1937, *Kari* (NY).

Botryosphaeria apocyni (Ell. & Ev.) Barr, comb. nov.

≡ *Laestadia apocyni* Ell. & Ev. Proc. Acad. Nat. Sci. Philadelphia 42: 230. 1891.

Ascocarps 120–165 μ diam, depressed globose, immersed, thickly scattered or grouped and connected by dark brown hyphae to form dull dark patches. Asci 40–52 × 9–14.5 μ. Ascospores 9.5–14.5 × 5–6.5 μ, hyaline, obovate, straight to inequilateral, the ends obtuse.

On dead stalks of *Apocynum* sp., eastern North America.

Material examined:

Ontario: *Ell. & Ev. N.A.F. 2540.*

Botryosphaeria smilacinina (Peck) Barr, comb. nov.

≡ *Sphaeria smilacinina* Peck, Annual Rep. New York State Mus. 29: 62. 1878.
≡ *Anthostomella smilacinina* (Peck) Sacc. Syll. Fungorum 1: 281. 1882.

= *Laestadia smilacinae* Dearn. & House, Bull. New York State Mus. 205–206: 53. 1918.
≡ *Guignardia smilacinae* (Dearn. & House) Dearn. & House, Bull. New York State Mus. 266: 73. 1925.

Ascocarps 100–150 μ diam, 100 μ high, depressed globose, immersed, with rounded erumpent apex, thickly scattered and connected by brown hyphae; wall 20 μ thick. Asci 38–53 × 12–18 μ. Ascospores 12–16.5 × 4.5–6.5 μ, hyaline to yellowish, broadly elliptic or obovate, straight to inequilateral, the ends obtuse; gelatinous cap-like appendage present at each end.

On overwintered leaves and stalks of *Smilacina stellata* (L.) Desf., eastern North America.

Material examined:

New York: Center, *C. H. Peck* (type of *Sphaeria smilacinina,* NYS); Karner, April, *C. H. Peck* (type of *Laestadia smilacinae,* NYS).

Evidently Saccardo's transfer of Peck's species to *Anthostomella,* based on the brief type description, misled Dearness and House into erecting *Laestadia smilacinae* for the same species. Specimens of the two collections are identical in all respects. Because Peck did not date his collections, the two cited above may have been part of the same collection (Karner = Center).

Botryosphaeria aesculi (Peck) Barr, comb. nov.

≡ *Laestadia aesculi* Peck, Annual Rep. New York State Mus. 39: 51. 1886.
≡ *Guignardia aesculi* (Peck) Stewart, Phytopathology 6: 9. 1916.

Ascocarps 148–200 μ diam, 115–150 μ high, depressed globose, immersed, thickly scattered; wall 16.5–23 μ thick. Asci 37–52 × 15–17 μ. Ascospores 13.5–18 × 6–8 μ, hyaline, obovate or elliptic, straight to inequilateral, the ends obtuse, rarely pointed.

Conidial state: *Phyllostictina sphaeropsoidea* (Ell. & Ev.) Petrak. Pycnidia mostly hypophyllous in leaf spots, 80–170 μ diam; conidiophores lining inner wall, short, 5 × 1.5 μ; conidia 10–15(–18) × 6–11.5 μ, broadly elliptic to nearly globose, hyaline, one-celled, with hyaline apical appendage. Microconidial state: *Asteromella aesculicola* (Sacc.) Petrak. Pycnidia in dead leaves, among ascocarps of immature ascal state, mostly hypophyllous, 40–80(–120) μ diam; conidiophores short, lining inner wall; conidia 3–6(–9) × 1–1.5(–3.5) μ, oblong, hyaline, one-celled, in gelatinous matrix.

The conidial state parasitic and causing dark reddish or brown leaf blotches, the perfect state in overwintered leaves and petioles of *Aesculus hippocastanum* L., *A. glabra* Willd., North America, Europe.

Material examined:

Massachusetts: *Barr 4157* (MASS). New York: Albany, 20 May 1885, *Clinton* (type, NYS); Orleans, 10 Aug 1913, *Diehl* (MICH, immature). Michigan: Lansing, Sept 1901, *Wheeler* (MICH, *Phyllostictina* state). District of Columbia: Washington, 17 Oct 1902, *Patterson* and *Dyre* (MICH, *Phyllostictina* state).

Stewart (1916) described and illustrated the development of the conidial, microconidial, and ascal states of this fungus. Petrak (1957) reported on the incidence of the disease in Europe. Three other species of the section were described and discussed recently:

Botryosphaeria vaccinii (Shear) Barr, Mycologia 62: 379. 1970.

Botryosphaeria rhodorae (Cooke) Barr, Mycologia 62: 381. 1970.

Botryosphaeria hyperborea Barr, Mycologia 62: 383. 1970.

Delphinella (Sacc.) Kuntze, Rev. Gen. Pl. 3(2): 74. 1898.

= *Hariotia* Karst. Bot. Morot. 3: 206. 1889, *non Hariota* Adans. 1763.
= *Glonium* Mühl. subgenus *Delphinella* Sacc. Syll. Fungorum 9: 1103. 1891.
= *Pleoglonis* Clements, Gen. Fungi 56, 173. 1909.
= *Rehmiellopsis* Bubák & Kabát, Naturwiss. Z. Forst- Landw. 8: 320. 1910.
= *Diplosphaerella* Grove, J. Bot. 50: 91. 1912.
= *Polycarpella* Theiss. & Sydow, Ann. Mycol. 16: 28. 1918.

Ascocarps globose, depressed, or conic, immersed, small to middle-sized; wall relatively thick, of few layers of large polygonal cells, brown, forming *textura angularis*. Asci bitunicate, polysporous, oblong, clavate, or saccate, the locule tissue compressed at maturity. Ascospores overlapping bi- to triseriate or crowded in the ascus, obovate or oblong, tapered from rounded apex to obtuse or pointed base, hyaline or yellowish, one-septate; wall smooth.

Conidial state where known: *Dothiorella*; conidia hyaline, one-celled, fusoid, formed in thick-walled pycnidia.

Saprobic or parasitic on leaves, twigs, and cone scales of gymnosperms, leaves and peduncles of woody dicotyledons, widespread in subarctic and temperate regions.

Müller (1953b) and Müller and von Arx (1962) discussed the generic synonyms of *Delphinella*.

Type species: *D. strobiligena* (Desm.) Clements & Shear.

Delphinella strobiligena (Desm.) Clements & Shear, Genera of Fungi, 49. 1931.

The type species has not yet been found in North America. Müller (1953b) provided description and synonymy of it.

Additional species:

Delphinella abietis (Rostr.) Müller in Müller & von Arx, Beitr. Kryptogamenfl. Schweiz 11(2): 26. 1962.

For synonymy of the species see Müller in Müller and von Arx (1962).

Ascocarps 145–200 μ diam, globose or depressed, immersed, the plane apex erumpent. Asci 50–90 × 18–22 μ, 16–32-spored. Ascospores not constricted at the median septum, 11–21 × 4–6.5 μ, hyaline, obovate, the ends obtuse.

Conidial state: *Dothiorella* (*Phoma bohemica* Bubák & Kabát). Pycnidia 150–200 μ diam, with aspect similar to that of ascocarps; conidia 10–16 × 4–6.5 μ, hyaline, fusoid, one-celled.

On living leaves of *Abies* spp., Europe, North America, Asia.

Waterman (1945) described and discussed this species which was found on *Abies lasiocarpa* in British Columbia. She compared it with the following species. *D. abietis* has narrower asci and smaller ascospores than does *D. balsameae*.

Delphinella balsameae (Waterman) Müller in Müller and von Arx, Beitr. Kryptogamenfl. Schweiz 11(2): 27. 1962. Figures 45–46.

≡ *Rehmiellopsis balsameae* Waterman, J. Agric. Res. 70: 327. 1945.

Ascocarps (135–)200–280 μ diam, 135–165(–200) μ high, globose or depressed, immersed with apex erumpent, thickly scattered; wall 15–40 μ thick. Asci 85–123 × 27.5–40 μ, 16-spored. Ascospores not constricted at the median septum, 26–38(–50) × 5.5–9(–12) μ, hyaline or yellowish, oblong or narrowly obovate, the ends obtuse.

On living leaves of *Abies* spp., northeastern North America.

Material examined:

Maine: Jim Pond Twp., 20 June 1940, *Waterman & Aldrich* (NYS). Massachusetts: Hamilton, *MacKenzie & Aldrich* (NYS); Hamilton, 3 Apr 1935, *Hansbrough* (MASS); Hamilton, 26 June 1935, *McKenzie* (MASS). New York: Lake George, Warren Co., 2 Nov 1933, *McKenzie & Aldrich* (NYS).

Apparently no conidial state is produced by this species. Waterman (1945) noted that cultures made from ascospores had a black yeast-like aspect, and that conidia were budded from hyphae. On sterilized *Abies* leaves which were inoculated with hyphae of *D. balsameae* only sterile fruiting structures were formed.

Delphinella tsugae (House) Barr, comb. nov. Figures 42–44.

≡ *Sphaerella tsugae* House, Bull. New York State Mus. 205–206: 40. 1919.
≡ *Mycosphaerella tsugae* (House) House, Bull. New York State Mus. 233–234: 31. 1921.
= *Sphaerella conigena* Peck, Annual Rep. New York State Mus. 38: 104. 1885, *non* Peck 1880, nec Ell. & Ev. 1891.
= *Sphaerella peckii* Sacc. Syll. Fungorum 9: 649. 1891, *non* Speg. 1880.
≡ *Mycosphaerella peckii* (Sacc.) Lindau in Engler & Prantl, Natürl. Pflanzenfam. 1(1): 425. 1897.

Ascocarps 100–208 μ diam, globose or slightly depressed, scattered singly or several grouped and walls connected by hyphae. Asci 60–90 × 11–16 μ, oblong, about 32-spored. Ascospores 9–13.5 × 3–4 μ, hyaline, obovate, rounded above and strongly tapered to pointed base; septum supramedian.

On cone scales of *Tsuga canadensis* (L.) Carr., eastern North America.

Material examined:

Quebec: *Barr 1871* (MASS). Maine: *Barr 3263, 3467* (Mass). New Hampshire: *Barr 3881* (MASS). Vermont: *Barr 4188* (MASS). Massachusetts: *Barr 2915, 3206, 4971* (MASS). New York: Knowersville, May, *C. H. Peck* (type of *Sphaerella conigena* Peck, 1885, NYS); Helderberg Mts., May, *C. H. Peck* (NY). West Virginia: Fayette Co., 16 Dec 1893, *L. W. Nuttall* (MICH).

Peck described two different species as *Sphaerella conigena.* The earlier name dates from 1880 and designates an eight-spored fungus on cones of *Thuja.* This species is transferred to *Scirrhia* in the present paper. Peck's second *S. conigena* has polysporous asci and occurs on cones of *Tsuga.* It is closely related to *D. strobiligena* on cones of *Pinus* spp. in southern Europe. The latter has larger ascocarps and elongate-ovate rather than obovate tapered ascospores. A third use of the name *Sphaerella conigena*, (Ellis and Everhart 1892) was for a fungus which appears to belong in *Massarina* in the Pleosporales.

Delphinella polyspora (Johans.) Müller in Müller & von Arx, Beitr. Kryptogamenfl. Schweiz 11(2): 27. 1962.

Müller (in Müller and von Arx 1962) provided synonymy for this species. It is subarctic in distribution, occurring on *Loiseleuria* and *Diapensia* in northern Europe and North America. I have described and illustrated this fungus (as *Mycosphaerella polyspora*) from several collections made in northeastern North America (Barr 1959). *D. polyspora* has smaller, more conic ascocarps than the other species of the genus.

Scirrhia Nits. in Fuckel, Symb. Mycol. 220. 1870, emend.

Ascocarps depressed globose, rounded, linear, or irregular, uni- or multiloculate, immersed, becoming erumpent, opening by an apical pore which is stuffed with small cells at first; wall composed of vertically oriented rows of brown or reddish brown cells forming *textura globosa* or *textura angularis,* between locules often as *textura prismatica;* outermost layers blackened, the inner cells brown to hyaline; brown hyphae penetrating host tissues. Asci oblong or clavate, tapered to a foot-like base, bitunicate, octosporous, nearly parallel from basal cells into tissue of locule which is compressed between and remains intact over apices of asci. Ascospores overlapping biseriate in the ascus, hyaline or yellowish, narrowly elliptic or obovate; septum nearly median, constricted or not, upper portion at times broader than lower, straight or often inequilateral; contents homogeneous or minutely guttulate; wall smooth.

Conidial states: *Hadrotrichum* Fuckel: conidiophores as short surface cells of erumpent stromata, sympodial; conidia produced singly and successively as blown out

ends of growing point, brown, globose, one-celled, wall thick and rough. *Dothistroma* Hulbary: conidiophores lining locules of elongate erumpent stromata, as end cells of vertically arranged hyphae composing base of locule; conidia hyaline, cylindric, several-septate, wall smooth. Microconidial state described as *Asteromellopsis* Hess & Müller. Illustrations of the conidial states may be found in Obrist (1959), Funk and Parker (1966), and Hess and Müller (1951), respectively.

Saprobic or parasitic on culms of monocotyledons, leaves and cone scales of gymnosperms, branches or stalks of woody dicotyledons; widespread in temperate or warm regions.

Müller and von Arx (1962) synonymized the genera *Scirrhodothis, Scirrhophragma,* and *Metameris* under *Scirrhia.* From my study of the type species of these genera, I believe that they all differ from *Scirrhia.* Theissen and Sydow (1915) erected *Scirrhodothis* for *Scirrhia confluens* Starb. [= *S. aspidiorum* (Lib.) Bubák] because they found paraphyses in the locule. Later (1918) they included the genus with *Scirrhia.* Petrak (1927, 1953) suggested that *S. aspidiorum* was similar to *Didymella.* Obrist (1959) considered that the fungus was a species of *Scirrhia* and described another species on fern petioles, *S. osmundicola.* It is my opinion that *S. aspidiorum* differs generically from *Scirrhia rimosa* and that the genus *Scirrhodothis* must be placed in the Pleosporales.

Scirrhophragma was based on *S. regalis* Theissen and Sydow (1915), a name which Obrist (1959) recognized was predated by *S. osmundae* (Peck & Clinton) Obrist. *Metameris japonica* Theissen and Sydow (1915) was described from *Osmunda regalis* var. *japonica.* Obrist tentatively considered it to be identical with *Scirrhophragma osmundae;* von Arx studied Japanese material as well as European and united all three under the earliest name as *Scirrhia osmundae* (Peck & Clinton) von Arx (in Müller & von Arx, 1962). This fungus, the type species of both *Scirrhophragma* and *Metameris,* is a member of the Pleosporales. The ascospores are unusual—two septa are normally formed and the middle cell is slightly enlarged. The middle and tapered lower cell have minutely guttulate contents, whereas the smaller upper cell is homogeneous and clear. I suggest that *Scirrhophragma osmundae* is closely related to the genus *Paraphaeosphaeria* O. Eriksson.

Further complicating the delimitation of *Scirrhodothis* and *Scirrhophragma* are two other genera which are superficially similar in producing elongate stromata. *Rhopographus* Fuckel with type *R. filicinus* (Fr.) Fuckel seems to be most closely related to *Leptosphaeria,* as Müller and von Arx (1950) suggested, and is a member of the Pleosporales. The second genus which may be confused is *Dangeardiella* Saccardo and Sydow, with *D. macrospora* (Schroet.) Sacc. & Syd. the type species. This fungus forms elongate ascocarps which open at maturity by a narrow compressed slit. The elongate slit and structure of the locule indicate that *Dangeardiella* is a member of the Lophiostomataceae as Obrist (1959) has observed.

The genus *Mycosphaerellopsis* von Höhnel (1918), typified by *M. myricariae* (Fuckel) von Höhnel, seemed possible to accommodate the species with uniloculate ascocarps according to the brief generic diagnosis. Von Höhnel indicated that *Mycosphaerellopsis* belonged in the Pseudosphaeriaceae, and that it was similar to *Mycosphaerella* except that a mass of stromatic tissue remained between the asci. Examination of European material of the type species [*Sydow, Mycotheca germ. 1169, Sphaerella myricariae* (Fuckel) Sacc., BPI], convinced me that Petrak's (1923) disposition of the fungus under *Didmyella* and his reduction of *Mycosphaerellopsis* to synonymy with *Didymella* was the best solution. The tissue remaining between and above the asci is elongate cellular, i.e. pseudoparaphysate. A conidial fungus intimately associated with ascocarps on the same leaves is referrable to *Ascochyta.* Several species of this genus have been connected by cultural studies with species of *Didymella.* Von Arx (1949) placed *Mycosphaerellopsis* in synonymy with *Mycosphaerella,* but did not

provide details of the type species. Müller and von Arx (1962) later considered *Mycosphaerellopsis* a synonym of *Didmyella* and cited Petrak's (1923) discussion of the genus.

The concept of *Scirrhia* is here broadened to include species previously described as *Dothidea,* in which the ascospores are hyaline or light colored, usually narrowly elliptic and tapered to the pointed base, and whose contents are minutely granulate or guttulate. *Scirrhia* as emended includes taxa which may have uni- or multiloculate ascocarps. The asci in the locules are nearly parallel from the base, but may be so crowded at maturity that their arrangement is not clearly parallel.

Type species: *S. rimosa* (Alb. & Schw. ex Fr.) Nits. in Fuckel.

Scirrhia rimosa (Alb. & Schw. ex Fr.) Nits. in Fuckel, Symb. Mycol. 221. 1870. Figures 47–49.

≡ *Sphaeria rimosa* Alb. & Schw. ex Fr. Syst. Mycol. 2: 427. 1823.
≡ *Dothidea rimosa* (Alb. & Schw. ex Fr.) Fr. Summa Veget. Scand. 368. 1849.
≡ *Phoma rimosa* (Alb. & Schw. ex Fr.) West. Bull. Acad. Roy. Sci. Belgique 19(3): 116. 1852.
= *Dothidea rimosa β depauperata* Desm. in Rabenh. Fungi Europ. n. 349. 1859.
≡ *Scirrhia depauperata* (Desm.) Fuckel, Symb. Mycol. 221. 1870.

Ascocarps multiloculate, linear or elliptic, 0.5–8 cm long, 1–3 mm wide, 330–385 μ deep; locules 110–220 μ diam. Asci 60–75 × 14–17 μ. Ascospores constricted at the median septum, 15.5–24 × 5–6 μ, hyaline, obovate, the ends obtuse or pointed.

Conidial state: *Hadrotrichum phragmites* Fuckel: conidiophores as short surface cells of elongate stromata; conidia 12–16 μ diam, globose, brown, one-celled. Obrist (1959) illustrated this state and described *Acremonium*-like conidia which were produced in culture. The conidia were abstricted from ends of short side branches of hyphae and were hyaline, globose or ovoid.

On *Phragmites communis* Trin., Europe, Asia, North Africa.

Obrist (1959) and Müller and von Arx (1962) included North America in the range of this fungus but I have not seen any North American specimens. The description is drawn from data obtained from extralimital collections.

Additional species:

Scirrhia insculpta (Wallr.) Barr, comb. nov.

≡ *Dothidea insculpta* Wallr. Fl. Cryptog. German. 2: 864. 1833.
≡ *Plowrightia insculpta* (Wallr.) Sacc. Syll. Fungorum 2: 636. 1883.
≡ *Dothidella insculpta* (Wallr.) Theiss. & Syd. Ann. Mycol. 13: 310. 1915.
≡ *Systremma insculpta* (Wallr.) Hess & Müller, Ber. Schweiz. Bot. Ges. 61: 7. 1951.

Ascocarps multiloculate, rounded or elongate, 420–660 μ diam, or up to 1–1.5 mm long, the locules 78–104 μ diam. Asci 70–90 × 12–15 μ. Ascospores 18–22.5 × 5.5–6.5 μ, hyaline or yellowish or light brown, elliptic, constricted at the nearly median septum, the ends tapered to obtuse tips.

On *Clematis ligusticifolia* Nutt., *Clematis* spp., Europe, North America.

Material examined:

Montana: *Ell. & Ev. N.A.F. 2129* (as *Parodiella fruticola*); Sand Coulee, 11 Feb 1888, *Anderson* (NY). Colorado: *Ell. & Ev. Fungi Columbiani 718* (as *Otthia fruticola*); Fort Collins, 21 Mar 1896, *Baker* (NY).

Hess and Müller (1951) described the microconidial state of *S. insculpta* as *Asteromellopsis insculpta* Hess & Müller. The conidia were 1.5–2 × 1 μ, hyaline, rod-shaped, one-celled, formed from spore mother cells lining locules in the stroma. In addition to the microconidial state, macroconidia were formed occasionally in intensively dividing cells at the surface of the stroma. In describing development of *S.*

insculpta, Hess and Müller found that ascogenous hyphae in the stroma could be dicaryotized in one of several ways. Asci produced from dicaryotic hyphae developed into and compressed locule tissue as they enlarged.

In North America *S. insculpta* has been confused with *Parodiella fruticola* (Ellis & Everhart 1892). Both species inhabit stems of *Clematis ligusticifolia* in the western United States and the two often occur together. The shining black ascocarps of *S. insculpta* are usually larger and more erumpent than the dull black ascocarps of *P. fruticola.* Under the microscope the two species are readily distinguished. Numerous small locules occupy the upper portion of the ascocarp of *S. insculpta,* each containing a group of asci whose ascospores are only slightly pigmented. The ascocarps of *P. fruticola* contain a single large locule, the base is usually thickened and sterile and composed of large cells, while externally coarse brown hyphae form a basal tomentum. Within the locule, numerous asci develop among pseudoparaphyses and contain one-septate yellowish brown ascospores, 26–35(–39) × 10–15 μ. *P. fruticola* appears to be most closely related to species of *Herpotrichia* sens. str. in the Pleosporales.

Scirrhia concaviuscula (Ell. & Ev.) Barr, comb. nov.

≡ *Dothidea concaviuscula* Ell. & Ev. North Amer. Pyrenomyc. 612. 1892.
≡ *Plowrightia concaviuscula* (Ell. & Ev.) Sacc. Syll. Fungorum 11: 376. 1895.
≡ *Dothidella concaviuscula* (Ell. & Ev.) Theiss. & Syd. Ann. Mycol. 13: 312. 1915.

Ascocarps multiloculate, circular, elliptic, or irregular, 0.5–1 mm diam, 220–385 μ high, erumpent, the surface dull black, plane or depressed; locules numerous, 78–117 μ diam. Asci 36–54 × 10–13 μ Ascospores not or slightly constricted at median septum, 16–20 × 4–4.5 μ, hyaline, elliptic, the ends obtuse.

On dead branches of *Magnolia virginiana* L., eastern North America.

Material examined:

Ontario: *Fungi Columbiani 1925.* New Jersey: Newfield, March 1876, *Ellis* (as *Dothidea excavata*), 17 Feb 1879 (as *Curreya excavata*), March 1897 (all NY).

The description of *Dothidea concaviuscula* agrees well with my findings for the two earlier New Jersey collections but the other two specimens cited are immature. Ellis and Everhart described their species "on dead branches of *Magnolia glauca,* Newfield, N.J." The 1876 collections bears a few notes by Ellis and apparently is the type specimen of *Scirrhia concaviuscula.*

Scirrhia conigena (Peck) Barr, comb. nov. Figure 53.

≡ *Sphaerella conigena* Peck, Annual Rep. New York State Mus. 33: 34. 1880, *non* Peck 1885, nec Ell. & Ev. 1890.
≡ *Mycosphaerella conigena* (Peck) House, Bull. New York State Mus. 233–234: 126. 1921.
= *Sphaerella conicola* Peck in Sacc. Syll. Fungorum Addit. 1–4: 75. 1886.
= *Sphaerella canadensis* Ell. & Ev. North Amer. Pyrenomyc. 280. 1892.
= *Mycosphaerella thujae* Petrak, Ann. Mycol. 20: 179. 1922.

Ascocarps usually uniloculate, 120–180(–220) μ diam, slightly depressed, the apex short conic at times, immersed or erumpent; wall 15–25 μ thick, the cells blackish brown externally, hyaline toward interior; apical pore 30 μ wide. Asci 45–68(–80) × (12–)18–20 μ. Ascospores (11–)15–31.5 × (3.5–)5–7 μ, hyaline or yellowish, narrowly obovate, straight to inequilateral, not constricted at the median septum.

On leaves and cone scales of *Thuja* spp., North America.

Material examined:

Massachusetts: *Barr 1871* (MASS). New York: Helderberg Mts., July, *C. H. Peck* (type of *S. conigena,* NYS, NY). Idaho: Priest River, 12 May 1920, *Weir & Rhoads* (type of *M. thujae,* BPI). Washington: Ione, 6 July 1929, *Hedgcock* (BPI). California: *Calif. Fungi 485* (as *M. canadensis,* MICH, NY).

The duplication of the name "*Sphaerella conigena*" already was discussed under *Delphinella tsugae. Scirrhia conigena* has a wide range of ascospore sizes in the collections examined. Peck's type specimen from cones has ascospores 25–31.5 × 6.5–7 μ. I have been unable to locate authentic material of *Sphaerella canadensis,* but the original description (Ellis and Everhart 1892) gave ascospore sizes as 20–22 × 5–7μ. The California specimens identified as *S. canadensis* have ascospores 17–30.5 × 4–6.5 μ. In the type material of *M. thujae* the ascospores measured 11–15 × 4–5 μ; Petrak (1955) suggested that his species was immature material of *S. canadensis.* Shape and contents of ascospores are quite consistent throughout the collections, as are structure and aspect of ascocarps, locules, and asci.

Scirrhia pini Funk & Parker, Canad. J. Bot. 44: 1171. 1966.

Funk and Parker (1966) provided a detailed description and illustrations of *S. pini.* The conidial state is *Dothistroma pini* Hulbary, which has been recorded from North America, Europe, and Africa on numerous species of *Pinus.* The perfect state was described from *P. contorta* in British Columbia.

Funk and Parker compared this species with *Scirrhia acicola* (Dearn.) Siggers and noted generic differences between the two fungi, particularly in the asci and locule. According to comparative studies of both fungi and of the literature (Siggers 1939, Wolf & Barbour 1941), the locules of *S. acicola* are dothideaceous. For additional discussion of the fungus, see *Mycosphaerella dearnessii.*

Scirrhia crustosa Barr, sp. nov. Figures 50–52.

Ascocarpia 100–110 μ diametro, 70–100 μ alta, globoso-depressa, immersa vel erumpentia, hyphis brunneis consociatis. Asci 27.5–48.5 × 9–11 μ, oblongi, bitunicati. Ascosporae 9–12 × 2.5–3.5 μ, hyalinae, obovatae, uniseptatae.

Specimen typicum in ramulis emortuis *Spiraeae lucidae,* prope "north of Junction between highway and Trail 246, Bonner Co., Idaho, 8 June 1940," legit A. W. Slipp 679; in herb. Univ. Mass. depositum.

Ascocarps uniloculate, 100–110 μ diam, 70–100 μ high, depressed globose, immersed then erumpent; wall composed of two to four layers of polygonal cells; brown hyphae forming a thin dark crust one to two cell layers thick connecting groups of ascocarps. Asci 27.5–48.5 × 9–11 μ, oblong. Ascospores 9–12 × 2.5–3.5 μ, hyaline, obovate, straight or inequilateral, not constricted at the median septum.

On dead branches of *Spiraea lucida* Dougl., western North America.

Material examined:

Idaho: *Slipp 679* (type, MASS).

The thin crust connecting groups of ascocarps provides the main distinguishing characteristic of this small species.

Coccoidella v.Höhnel, Sitzungsber. Kaiserl. Akad. Wiss., Math.-Naturwiss. Kl. Abt. 1, 118: 847. 1909.

= *Eumicrocyclus* Hara, Bot. Mag. (Tokyo) 29: 52. 1915.

Ascocarps multiloculate, the superficial portion peltate, borne on a central foot-like hypostroma in leaf tissues; locules in a single layer in the stroma, globose or ovoid, opening by a small apical pore; walls of vertically oriented rows of thick walled, brown cells forming *textura angularis,* cells toward base of hypostroma forming *textura prismatica.* Asci oblong or saccate, bitunicate, octosporous. Ascospores overlapping biseriate or crowded in the ascus, hyaline to yellowish, finally dull brown, oblong or obovate; septum median; contents minutely guttulate.

Conidial state not known.

Parasitic on living leaves of *Magnolia* and *Persea* spp., southern United States.

Although Müller and von Arx (1962) assigned *Coccoidella* to the Venturiaceae, I am unable to concur. The locules of the type species are dothideaceous. The immersed hypostroma and superficial multiloculate ascocarps are somewhat reminiscent of those of *Rhizogene.* However, wall structure, locule cells which persist for a long time, and ascospore shape and contents all suggest a position within the Dothioraceae rather than the Dothideaceae.

Type species: *C. scutula* (Berk. & Curt.) v.Höhnel.

Coccoidella scutula (Berk. & Curt.) v.Höhnel, Sitzungsber. Kaiserl. Akad. Wiss. Math.-Naturwiss. Kl. Abt. 1, 118: 847. 1909. Figures 54–56.

≡ *Dothidea scutula* Berk. & Curt. North Amer. Fungi n. 889. 1859.
≡ *Dothidella scutula* (Berk. & Curt.) Sacc. Syll. Fungorum 2: 632. 1883.
≡ *Polystomella scutula* (Berk. & Curt.) Speg. Bol. Acad. Nac. Ci. 11: 381. 1889.
≡ *Microcyclus scutula* (Berk. & Curt.) Sacc. Ann. Mycol. 2: 165. 1904.
≡ *Eumicrocyclus scutula* (Berk. & Curt.) Hara, Bot. Mag. (Tokyo) 29: 52. 1915.
≡ *Coccoidea scutula* (Berk. & Curt.) Hara, Bot. Mag. (Tokyo) 29: 53. 1915.

Ascocarps 0.5–1.5 mm diam, 150–200 μ high; locules 60–90 μ diam, 80–100 μ high. Asci (40–)50–65 × 13–15.5 μ. Ascospores 15.5–21 × 5–6.5 μ, straight or inequilateral.

Usually epiphyllous on living leaves of *Magnolia* sp., *Persea borbonia* (L.) Spreng., southern United States.

Material examined:

South Carolina: *Ravenel, Fungi Am. exs. 371a, 478; Ellis N.A.F. 684.* Georgia: *Ravenel, Fungi Am. exs. 385.* Florida: *Fungi Columbiani 240, Rabenh.-Winter Fungi eur. 3559, Rehm Ascom. 1673* (with *Asterina pelliculosa*), 1669; *E. West 10224* (NY). Mississippi: Ocean Springs, 30 Mar 1889, *F. S. Earle* (NY); *S.M. Tracy 1075, 4048* (NY). Texas: Galveston, 1869, *H. W. Ravenel* (NY).

Sydowia Bres. Hedwigia 34: Beibl. 66. 1895.

= *Plowrightia* subgenus *Plowrightiella* Sacc. Syll. Fungorum 11: 376. 1895.
≡ *Plowrightiella* (Sacc.) Sacc. Syll. Fungorum 24: 543. 1926.
= *Pleodothis* Clements, Gen. Fungi 49, 173. 1909.
= *Keisslerina* Petrak, Ann. Mycol. 17: 74. 1919.
= *Jaapia* Kirschst. Kryptogamenfl. Mark Brandenburg 7(3): 444. 1938, *non* Bres. 1911.

Ascocarps usually uniloculate, depressed globose or conic, immersed becoming erumpent, the apex rounded or short papillate, opening widely at maturity; wall thick, several layers of cells forming *textura angularis* or approaching *textura prismatica,* darkened externally; hyaline or yellowish small cells forming a broad basal layer and occupying locule and pore area in immature ascocarps, the cells often in vertically oriented rows. Asci oblong or clavate, bitunicate, polysporous, arising in a layer or in a fascicle in small locules. Ascospores crowded and overlapping in the ascus, hyaline or becoming dull brown, obovate or elliptic, several-septate, constricted at the primary septum; vertical septum in mid cells when present, rarely in end cell; upper portion of ascospore broader and usually shorter than lower, straight to inequilateral; contents minutely guttulate; wall smooth.

Conidial state: *Dothichiza:* pycnidia pulvinate, globose or irregular, large; wall thick, dark; conidia produced from undifferentiated cells of inner wall, hyaline or brownish, elliptic or fusoid, one-celled (illustrated by von Arx, 1970). Also *Sclerophoma* (see *Sydowia polyspora*).

Parasitic or saprobic on leaves and branches of gymnosperms, branches of woody dicotyledons, temperate Europe, North America.

Plowrightia subgenus *Plowrightiella* was published for *Dothidea polyspora* the same year that *Sydowia* was erected. Müller (1953b) established that the names *D. polyspora* and *Sydowia gregaria* referred to the same species. Müller also noted that *Pleodothis*

was a superfluous name under the Code. *Keisslerina* was based on *K. moravica* Petrak on *Euonymus,* and was said to differ from *Dothiora* by thickly grouped, non-erumpent ascocarps and asci with 16(–24) spores. *Jaapia* was typified by *J. triglitziensis* Kirschst., also on *Euonymus.* Both Kirschstein (1938) and Petrak (1940) agreed that *Jaapia* was identical with *Keisslerina.* According to descriptions there is no generic difference between *Keisslerina, Jaapia,* and *Sydowia.*

Endodothiora Petrak (1929) with *E. sydowiana* has thin-walled ascocarps immersed in stromata of *Systremma puccinioides* (i.e. *Dothidea puccinioides*). The asci are polysporous and the ascospores hyaline with several transverse and occasional vertical septa. Perhaps the immersed parasitic habit is sufficient to separate *Endodothiora* from *Sydowia.*

Both sizes and shapes of ascospores within the genus *Sydowia* tend to be uniform. The species are distinguished chiefly on aspect of the ascocarps and the number of ascospores per ascus.

Type species: *S. polyspora* (Bref. & v.Tavel) Müller.

Sydowia polyspora (Bref. & v.Tavel) Müller, Sydowia 7: 342. 1953. Figures 57–58.

≡ *Dothidea polyspora* Bref. & v.Travel, Untersuch. Gesamtgeb. Mykol. 10: 296. 1891.
≡ *Plowrightia polyspora* (Bref. & v.Tavel) Sacc. Syll. Fungorum 11: 376. 1895.
≡ *Pleodothis polyspora* (Bref. & v.Tavel) Clements, Gen. Fungi, 49, 173. 1909.
≡ *Hariotia polyspora* (Bref. & v.Tavel) v.Höhnel, Ann. Mycol. 16: 168. 1918.
= *Sydowia gregaria* Bres. Hedwigia 34: Beibl. 66. 1895.
= *Dothiora pinacea* Vel. Monog. Discomyc. Bohem. 47. 1934.

Ascocarps 240–330 μ diam, 220–275 μ high, depressed globose, scattered or grouped and confluent at times, the apex rounded-plane; wall 40–80 μ thick. Asci 70–85 × 12–15 μ, 24–32-spored. Ascospores (9–)12–20(–28) × 3–5(–8.5) μ, hyaline, obovate, broadest above and narrowed to a pointed base, (1–2–)3(–6)-septate, occasionally with vertical septum in one to three cells.

Conidial states: *Sclerophoma magnusiana* Wilson & Hahn. *Dothichiza pityophila* (Corda) Petrak.

Saprobic or parasitic on branches and leaves of various gymnosperms: *Abies, Larix, Picea, Pinus, Pseudotsuga, Thuja,* and *Tsuga* spp., Europe and North America.

Material examined:

Quebec: Saint-Malachie, 26 May 1964, *Smerlis & Saint-Laurent* (NY). British Columbia: *DAOM 88497, 111294* (DAOM).

Müller (1963b) provided most of the synonymy cited above. Butin (1964) successfully demonstrated cultural connections between *Sydowia polyspora* and *Dothichiza pityophila.* He provided descriptions and synonymy of both states of the fungus. More recently, Smerlis (1970a) established the connection between *S. polyspora* and *Sclerophoma magnusiana.* He also established the pathogenicity of the fungus with respect to a number of gymnosperms, noting that cankers were produced on *Abies balsamea* from artificial inoculation and that *Sclerophoma* was reisolated the following spring from these cankers.

Additional species:

Sydowia dothideoides Dearn. & Barth. Mycologia 18: 248. 1926.

= *Dothiora polyspora* Shear & Davidson, Mycologia 32: 105. 1940.

Ascocarps 330–715 μ diam, or larger by confluence, 275–385 μ high, pulvinate rounded, thickly scattered and seated in hyphal subiculum, the apex plane or somewhat depressed; wall 40–90 μ thick, up to 130 μ at base; ascocarp at times two-locular. Asci 90–120 × 18–20 μ, 24–32-spored. Ascospores (13–)16–18(–24) × (4–)5–8 μ, hyaline, obovate, broadest above and tapered to the pointed or obtuse

base, 3 (–4–6)-septate, constricted at the primary septum, with vertical septum in one or more of mid cells, rarely into one end cell.

Conidial state: *Dothichiza:* pycnidia on sterilized and inoculated *Salix* twigs erumpent in hyphal subiculum; conidia 8–9 × 4–5 μ, hyaline, oblong, one-celled. On naturally infected *Salix* twigs pycnidia thickly scattered, 250 μ diam, 165 μ high, immersed in hyphal subiculum; conidia 6.5–13 × 3–4 μ, hyaline, oblong, one-celled.

On thin branches and twigs of *Populus tremuloides* Michx., pycnidia or immature ascocarps on *Salix* sp., western North America.

Material examined:

Wyoming: Jenny Lake, 14 July 1924, *Bartholomew 8792,* 2 packets (type of *S. dothideoides, Dearness Herb. 5710,* in DAOM). Colorado: Mesa Lake, Grand Mesa, 1 June 1938, *Davidson 4222,* 2 packets (type and isotype of *D. polyspora,* BPI). immature on *Salix,* same locality, 17 June 1930, 2 packets, 1 June 1938 (BPI); on sterilized *Salix* twig, *Dothichiza* from ascospore cultures (BPI).

The copious subiculum beneath thickly grouped ascocarps characterizes this species. Smerlis (1970a) noted similarity in morphological characteristics between *S. dothideoides* and *Dothiora polyspora,* and suggested that these were possibly synonymous entities.

Sydowia pruni Barr, sp. nov. Figure 61.

Ascocarpia 385–660 μ diametro, 275–440 μ alta, pulvinata, erumpentia singulatim vel in catervis ellipticis vel in seriebus elongatis, peridio 78–104(–195) μ crasso. Asci 104–140 × 15–23.5 μ, oblongi, bitunicati, polyspori. Ascosporae 13–18 × 5–6 μ, hyalinae, obovatae, 3 (–4–5)-septatae et septo verticali instructae.

Specimen typicum in ramulis emortuis *Pruni demissae,* prope "Marble, Washington, 30 July 1935," legit *G. G. Hedgcock,* in herb. National Fungus Collections depositum.

Ascocarps 385–660 μ diam, 275–440 μ high, pulvinate, erumpent singly or in small elliptic groups or elongate rows; wall 78–104(–195) μ thick, the cells sclerotial. Asci 104–140 × 15–23.5 μ, more than 32-spored (up to 42 counted). Ascospores 13–18 × 5–6 μ, hyaline, obovate, straight, inequilateral or somewhat bent, broadest above and tapered to a pointed base, 3 (–4–5)-septate, constricted at the primary septum, with vertical septum in one or both mid cells and often in upper end cell.

On branches of *Prunus demissa* (Nutt.) D. Dietr., *P. melanocarpa* Nels., western North America.

Material examined:

Washington: Marble, 10 June 1935, *For. Path. 66556,* 29 July 1935, *For. Path. 68377,* 30 July 1935, *For. Path. 68385* (type) (all BPI, identified by Dearness as *S. dothideoides* var. *pruni-demissae* Dearn. ined.). Wyoming: Jenny Lake, 11 July 1924, *Bartholomew 8782a* (as *S. melanocarpa* Dearn. ined., *Dearness Herb. 5710,* in DAOM).

The absence of a copious subiculum and the formation of more than 32 ascospores per ascus sufficiently separates *S. pruni* from *S. dothideoides.*

Sydowia lepargyrea Dearn. ex Barr, sp. nov.

Ascocarpia 330–440 μ diametro, 275–330 μ alta, pulvinata, erumpentia singulatim vel aliquot consociata, peridio latere 52–65 μ crasso, fundusque ad 104 μ. Asci 90–104 × 15.5–20 μ, oblongi, bitunicati, polyspori. Ascosporae 14–18(–22) × 3.5–5 μ, hyalinae, obovatae, (1–)3 (–4–7)-septatae et septo verticali instructae.

Specimen typicum in ramulis emortuis *Shepherdiae canadensis,* prope "east of Aladdin, Washington, 15 May 1931," legit *G. G. Hedgcock*; in herb. Dearness in DAOM depositum.

Ascocarps 330–440 μ diam, 275–330 μ high, pulvinate, dull black, scattered or two or three connected, erumpent, the apex plane; wall 52–65 μ thick at sides, up to 104 μ thick below. Asci 90–104 × 15.5–20 μ, more than 32-spored. Ascospores 14–18(–22) × 3.5–5 μ, hyaline, obovate, broadest above and tapered to the pointed base, (1–)3 (–4–7)-septate, with vertical septum in one or more of mid cells.

On dead twigs of *Shepherdia canadensis* (L.) Nutt., western North America.

Material examined:

Washington: east of Aladdin, 15 May 1931, *Hedgcock* (type, as *S. lepargyrea* Dearn. n.sp., *Dearness Herb. 8224,* in DAOM); Ione, 11 July 1935, *Hedgcock* (Dearness Herb. in DAOM).

Sydowia lepargyrea seems closely related to *S. pruni,* differing especially in smaller less crowded ascocarps and narrower ascospores. Immature ascocarps of *S. lepargyrea* contain a small rounded locule crowded with asci; in more mature ascocarps the asci occupy a large broad area and are definitely parallel.

Sydowia versiformis Barr, sp. nov. Figures 59–60.

Ascocarpia 440–660 μ diametro, 330–440 μ alta, pulvinata, rotunda vel elliptica, erumpentia singulatim, peridio latere 60–80 μ crasso, fundusque ad 180 μ. Asci 120–140 × 20–26 μ, oblongi, bitunicati, polyspori. Ascosporae 8–10 × 3.5–4.5 μ et 0–1-septatae aut 17–25 × 6–9 μ et 3–5-septatae, hyalinae vel fuscae, ellipticae vel obovatae, septo verticali instructae.

Specimen typicum in ramulis emortuis *Sorbi sitchensis,* prope "Mt. Revelstoke, British Columbia, 23 July 1963," legit *R. A. Shoemaker,* sub DAOM *105213,* in herb. DAOM depositum.

Ascocarps 440–660 μ diam, 330–440 μ high, pulvinate, elliptic or rounded from above, thickly scattered, erumpent separately; locule single, composed of vertically oriented rows of cells, blackened externally, hyaline within; wall at maturity 60–80 μ thick at sides and upper surface, up to 180 μ deep at base. Asci 120–140 × 20–26 μ, broadly oblong, parallel, polysporous, the ascospores closely packed and difficult to count. Ascospores 8–10 × 3.5–4.5 μ and 1-celled or 1-septate, 17–25 × 6–9 μ and 3–5-septate, hyaline to brown, elliptic or obovate, often broadest above and tapered to the pointed base, constricted at the primary septum or often at all septa, with vertical septum in one or more mid cells.

On dead branches of *Sorbus sitchensis* Roem., *S. occidentalis* (Wats.) Greene, western North America.

Material examined:

British Columbia: *DAOM 105213* (type, DAOM); *Barr 668a* (MASS).

The ascospores in this species are extremely variable in size, shape, and septation. Within one ascus all variations may occur and these ascospores are difficult to separate from one another for counting or measuring. There appear to be more than 32 ascospores produced in an ascus.

Shoemaker (pers. comm.) noted that the ascospores of *S. versiformis* budded in the ascus, but no octosporous asci were found in the specimens examined. For this reason the species was compared closely with *Dothiora pyrenophora* on the same host genus. Ascocarps are similar in aspect and structure and are slightly smaller in *S. versiformis*; asci in the latter species are approximately twice the size of those in *D. pyrenophora*; the largest ascospores of *S. versiformis* are within the size range for ascospores of *D. pyrenophora,* and in the two species the ascospores are similar in shape and variable in septation. The major difference noted by comparison was in ascus sizes, while all other characteristics seem to be within the range of variability of species in the Dothioraceae. With the present evidence I must consider the two entities as distinct species.

Associated with *S. versiformis* in both collections cited is a Pleosporaceous fungus with larger muriform ascospores. A number of sections contained overmature ascocarps of the *Sydowia* and young or mature ascocarps of the other fungus in close proximity. Wall structure distinguishes the two species if asci and ascospores are not present. The Pleosporaceous fungus which seems to be a variant of *Cucurbitaria sorbi* Karsten has thinner side walls, but the basal wall may be thickened. Wall cells are not arranged in

vertical rows as they are in *S. versiformis. C. sorbi* is associated with *Dothiora pyrenophora* in several European collections which I have examined.

Dothiora Fr. Flora Scanica 347. 1835–37 (name only); Summa Veget. Scand. 418. 1849.

= *Plowrightia* Sacc. Syll. Fungorum 2: 635. 1883.
= *Dothiora* subgenus *Metadothis* Sacc. Syll. Fungorum 8: 764. 1889.
= *Leptodothiora* v.Höhnel, Ann. Mycol. 18: 78. 1920.

Ascocarps uni- or multiloculate, pulvinate to depressed globose, immersed becoming erumpent; apex plane, broadly rounded, or short and blunt papillate, opening by small or irregular pore area; ascocarps scattered or grouped, at times in long rows, as locules, either rounded or ring-like, in small stroma at times; wall thick, several layers of large cells forming *textura angularis,* often oriented vertically in rows, blackened externally, hyaline or light brown inner layers of small polygonal or somewhat compressed cells forming a broad basal cushion and locule wall, filling locule and stuffing pore area before asci develop. Asci oblong or short clavate, arising from base in parallel group, bitunicate, octosporous, dissolving locule tissue. Ascospores hyaline or occasionally yellowish or light dull brown, obovate or elliptic, often inequilateral or slightly curved or bent, (one–)several-septate, the primary septum nearly median and usually constricted; vertical septum in one or several mid cells, rarely in an end cell, not formed in some species; contents homogeneous or minutely guttulate; wall smooth, occasionally surrounded by a thin gelatinous coating.

Conidial state: *Dothichiza* Lib. (see p. 568 under *Sydowia*).

Saprobic in leaves, branches and cone scales of gymnosperms, branches of woody dicotyledons, widespread in temperate regions.

The presence or absence of a vertical septum in the ascospores is an extremely variable characteristic in this genus. Consistent similarities exist in ascocarp structure, locule formation, and ascospore shape. When the species are arranged in a sequence based on length of ascospores, the smallest had no vertical septa, the largest consistently had vertical septa, and intermediate species occasionally had vertical septa. Thus *Dothiora* subgenus *Metadothis* and *Leptodothiora,* both erected for phragmosporous species, are united with *Dothiora.* The type species of *Plowrightia, P. ribesia,* agrees in all respects with my concept of *Dothiora.* Removal of this and other species from *Dothidea* results in a more natural grouping both in *Dothidea* and in the other genera concerned.

Clements and Shear (1931) placed *Protoscypha* Sydow in the synonymy of *Dothiora.* Miller and Burton (1943) merged *Pittierodothis* Chardon with *Dothiora. Pittierodothis* is identical with *Protoscypha* and closely related to *Annajenkinsia,* according to von Arx (1963). These genera appear to belong in the Arthoniaceae.

The species of *Dothiora* may be grouped in three series based on ascospore shape and septation. *D. pyrenophora* and *D. thujae* have obovate ascospores with broadly rounded ends; both transverse and vertical septa are formed. Reduction of ascocarp size in *D. thujae* from *D. pyrenophora* points the way to *Saccothecium*. In the second group of species the ascospores are more narrowly obovate and taper to the pointed base and have both transverse and vertical septa. The third group of species has narrowly elliptic or obovate ascospores, usually pointed at the ends, and transverse septa only.

1. Series of *D. pyrenophora*:
Type species: *D. pyrenophora* (Fr.) Fr.

Dothiora pyrenophora (Fr.) Fr. Summa Veget. Scand. 418. 1849. Figures 62–64.

≡ *Dothidea pyrenophora* Fr. Syst. Mycol. 2: 552. 1823.

= *Hysterium sorbi* Wahl. ex Fr. *non Sphaeria sorbi* Wahl. ex Fr. *nec Sphaeria sorbi* Schmidt ex Fr.
≡ *Dothiora sorbi* (Wahl. ex Fr.) Fr. Summa Veget. Scand. 418. 1849; Fuckel, Symb. Mycol. 273. 1870.

Ascocarps 550–1000 μ diam, 275–495 μ high, rounded or elliptic or pulvinate, immersed becoming erumpent, the surface plane or slightly depressed, dull black; ascocarps composed of vertically oriented rows of cells forming *textura angularis*, blackened externally, brownish or pallid toward interior, brown hyphae penetrating host tissues; locule marginal as a ring, in median section appearing as two locules with sterile central portion or in some specimens the locule occupying the central portion also, 220–330 μ wide, 137–165 μ high. Asci 60–75 × 10–15 μ, from a low basal cushion of cells or at times an arched cushion, rarely fewer than 8 ascospores maturing. Ascospores (14–)22–35 × 6–9 μ, hyaline, occasionally light dull brown, obovate (the ends obtusely rounded), 3–8-septate, with vertical septum through mid cells, rarely into one end cell.

Conidial state: *Dothichiza sorbi* Lib.

On branches of *Sorbus* spp., Europe, North America.

Material examined:

Ontario: Field P.O., North Bay District, 13 July 1959, *D. Griffith & L. S. MacLead* (NY); *DAOM 91685* (DAOM). British Columbia: *DAOM 111288* (DAOM).

Additional species:

Dothiora thujae (Grove) Barr, comb. nov. Figure 72.

≡ *Pleospora thujae* Grove, J. Bot. 50: 49. 1912.

Ascocarps 130–245 μ diam, nearly globose, single or few grouped together and connected by hyphae; wall 20–50 μ thick, thickest at base; apex rounded papillate. Asci 37.5–63 × 18–27 μ, broadly oblong. Ascospores 20–30 × 6–9 μ, yellowish brown, obovate, with ends obtuse, straight to inequilateral, (3–)5 (–7)-septate, constricted at the primary and less at the secondary septa, with vertical septum (rarely two) in mid cells, occasionally extending into the apical cell; thin gelatinous coating 1.5–2 μ thick at times surrounding ascospores.

On cone scales of *Thuja occidentalis* L., Europe, North America.

Material examined:

Maine: *Barr 3232*. Quebec: *Barr 2019* (MASS).

The North American collections are in close agreement with Grove's description from English material. Wehmeyer (1961) did not examine this species, but suggested that it appeared from the description to be near *Pleospora phaeocomoides*.

2. Series of *D. rimincola*:

Dothiora rimincola (Schw.) Barr, comb. nov.

≡ *Hysterium rimincola* Schw. Trans. Amer. Philos. Soc. II. 4: 244. 1832.
≡ *Dothidea rimincola* (Schw.) Peck, Annual Rep. New York State Mus. 30: 64. 1878.

Ascocarps 500–1500 μ long or longer by confluence, 385–440 μ wide, 220–270 μ high, elongate or elliptic, erumpent in long rows; wall thick, externally dark brown and 26–39 μ thick, interior layers yellowish or hyaline and 26–35 μ thick, the basal hyaline region forming a raised cushion 52–78 μ deep in mid portion of locule; apex plane or slightly depressed from sides, surface pulverulent dull blackish. Asci 50–70 × 12–15 μ, oblong clavate. Ascospores inequilateral, 17–25 × 4–5 μ, hyaline, obovate, tapered to an obtuse or pointed base, the upper portion broader than the lower, (1–3–)5–7-septate, constricted at supramedian primary septum, with vertical septum in one or more mid cells.

On dead branches of *Diervilla lonicera* Mill., eastern North America.

Material examined:

New York: Buffalo, May, *G. W. Clinton* (NYS). Pennsylvania: Bethlehem, ex Herb. *Schweinitz* (isotype, NYS).

Peck transferred this species from *Hysterium* to *Dothidea* and noted that no linear slit was evident in the ascocarps. Apparently ascospore discharge is effected by breakdown of the entire upper wall. A single elongate locule is present, and the raised basal tissue is suggestive of that found in many specimens of *Dothiora pyrenophora,* and more pronounced in *Saccothecium.* The ascospores are typical in shape and septation of the second series of species in *Dothiora.* From the other species of the genus *D. rimincola* differs by the greatly elongate ascocarps.

Dothiora staphylina (Peck) Barr, comb. nov.

≡ *Sphaeria staphylina* Peck, Bull. Buffalo Soc. Nat. Sci. 1: 72. 1873; Annual Rep. New York State Mus. 26: 86–87. 1874.
≡ *Metasphaeria staphylina* (Peck) Sacc. Syll. Fungorum 2: 167. 1883.

Ascocarps 208–440 μ diam, 117–220 μ high, uni- or multi-loculate; wall 26 μ thick at sides, up to 90 μ at lower sides at times; apex plane, the pore area pallid under dissecting microscope. Asci 65–90 × 12–16 μ, oblong. Ascospores 18–22.5 × (4–)5–6(–7) μ, hyaline, obovate (the upper portion broader than the lower), straight to inequilateral, tapered to an obtuse base, (1–)3–5 (–7)-septate, slightly constricted at the primary septum, with vertical septum in one or two of mid cells.

On *Staphylea trifolia* L., eastern North America.

Material examined:

New York: Helderberg Mts., May, *C. H. Peck* (type, NYS).

Metasphaeria staphylea Dearn. & House, also described from *Staphylea,* is *Clathridium corticola* (Fuckel) Shoemaker & Müller. Dearness had annotated the type packet of Peck's fungus as *Hysterium,* but later, according to information on the packet, changed his mind about transferring the fungus. The description of *Dothiora staphyleae* Allescher in Sylloge Fungorum 16, p. 790, is very suggestive of *D. staphylina,* as is that of *Leptodothiora austriaca* Petrak in Sydowia 9: 576. 1955, and the three may be identical.

Dothiora sambucina (Peck) Barr, comb. nov. Figures 67–69.

≡ *Sphaerulina sambucina* Peck, Annual Rept. New York State Mus. 38: 106. 1885.

Ascocarps 230–245 μ diam, 180–200 μ high, often erumpent in long rows; wall 26–33(–50) μ thick; apex short and broadly papillate. Asci 52–78 × 15 μ, oblong. Ascospores 22.5–27 × 6–7.5 μ, hyaline, obovate (the upper portion broader than the lower), tapered to an obtusely pointed base, often inequilateral, (1–)3–6-septate, constricted at supramedian primary septum, with vertical septum in one or several of mid cells.

On branches of *Sambucus* sp., eastern North America.

Material examined:

New York: West Albany, May 1884, *C. H. Peck* (type, NYS).

Dothiora sphaeroides (Pers. ex Fr.) Fr. Summa Veget. Scand. 419. 1849.

≡ *Dothidea sphaeroides* Pers. ex Fr. Syst. Mycol. 2: 552. 1823.

Ascocarps 220–440 μ diam, 165–275 μ high, pulvinate with rounded apex, erumpent, thickly scattered or few connected; wall thick; thick brown hyphae forming a layer at base, thin hyphae penetrating cortical tissues of host. Asci 62–72 × 12–15 μ, parallel in a broad locule. Ascospores 20–25 × 5–6 μ, hyaline, obovate,

broadest above and tapered to a pointed base, (1–3–)5–7-septate, with vertical septum in one or several of mid cells, occasionally through upper end cell.

Conidial state: *Dothichiza tremulae* (Sacc.) v.Höhnel.

On branches of *Populus* spp., Europe, North America.

Material examined:

Ontario: Holland River Marsh, York Co., 30 Apr 1936, *H. S. Jackson* (*DAOM 86261*, Herb. of R. F. Cain).

The ascospores in this collection are slightly larger than those described from European specimens.

Dothiora schizospora Luttrell, Mycologia 52: 65. 1960.

On branches of *Symphoricarpos orbiculatus* Moench, North America.

Luttrell (1960) provided description, illustrations, and details of developmental morphology of this species.

3. Series of *D. taxicola*:

Dothiora taxicola (Peck) Barr, comb. nov. Figures 70–71.

≡ *Sphaeria taxicola* Peck, Annual Rep. New York State Mus. 24: 99. 1872.
≡ *Leptosphaeria taxicola* (Peck) Sacc. Syll. Fungorum 2: 85. 1883.
≡ *Metasphaeria taxicola* (Peck) Peck, Annual Rep. New York State Mus. 39: 58. 1886.
≡ *Sphaerulina taxicola* (Peck) Berlese, Icones Fungorum 1: 125. 1894.
≡ *Saccothecium taxicolum* (Peck) Kirschst. Kryptogamenfl. Mark Brandenburg 7(3): 427. 1938.
= *Sphaerella taxi* Cooke, Gard. Chron. 9: 274; Grevillea 6: 121. 1878.
≡ *Metasphaeria taxi* (Cooke) Oudemans, Ned. Kruidk. Arch. III, 2: 170. 1900.
≡ *Sphaerulina taxi* (Cooke) Massee, Diseases Cult. Pl. 220. 1910.

Ascocarps 130–240 μ diam, 145–165 μ high, globose or depressed, immersed with rounded erumpent apex, epiphyllous, thickly scattered; wall 14–30 μ thick, consisting of several layers of polygonal cells, blackened externally; apical pore region stuffed with lighter brown or hyaline cells before maturity. Asci 60–96 × 9–14.5 μ, clavate, arising from a low dome-shaped cushion of hyaline cells. Ascospores 13–18.5 × 3–5 μ, hyaline or yellowish, narrowly elliptic or obovate, tapered to pointed ends, straight to slightly curved, (1–)3-septate, not constricted at septa; contents minutely guttulate; wall smooth.

Conidial state: *Dothichiza* sp.: Callen (1938–1939) obtained the conidial state of the fungus in culture as well as in leaf tissue, and identified it with *Cytospora taxifolia* Cooke and Massee. The pycnidia are immersed, depressed, 418–435 μ diam, 243-352 μ high, multiloculate; conidiophores short, 7–15 × 1.5–2 μ; conidia 3–5 × 1 μ, hyaline, one-celled.

On leaves of *Taxus* spp., North America, Europe.

Material examined:

British Columbia: *DAOM 88044, 88045* [DAOM, in collections of *Asteridiella pitya* (Sacc.) Hansf.]. New York: Sandlake, May 1871, *C. H. Peck* (type of *Sphaeria taxicola*, NYS). California: *Calif. Fungi 293, 570; H. E. Parks 4400* (MICH). England: *Sphaer. Brit. 90* (as *Sphaerella taxi*).

According to descriptions and to material examined, the British and North American specimens do not differ specifically. Callen (1938–1939) described and discussed the British specimens under the name *Sphaerulina taxi*. Ascospores in British material are somewhat larger than North American, 20–37.5 × 6.5–9 μ, and occasionally become five-septate.

Dothiora slippii Barr, sp. nov.

Ascocarpia 250–300 μ diametro, pulvinata, in seriebus elongatis, peridio usque ad 60 μ crasso. Asci 48–60 × 11–13 μ, oblongi vel clavati, bitunicati. Ascosporae 17.5–24 × 3.5–4.5 μ, hyalinae, anguste obovatae, 3-septatae.

Specimen typicum in ramulis emortuis *Pini albicaulis,* prope "Looking Glass Lookout, Priest River Experimental Forest, Bonner Co., Idaho, 10 Oct 1939," legit *A. W. Slipp 584A;* in herb. Univ. Mass. depositum.

Ascocarps 250–300 μ diam, pulvinate, often in rows along a branch; apex plane, opening irregularly; wall up to 60 μ thick. Asci 48–60 × 11–13 μ, oblong to clavate, parallel from a basal cushion of hyaline cells. Ascospores 17.5–24 × 3.5–4.5 μ, hyaline, narrowly obovate, tapered to pointed ends, straight or slightly curved, 3-septate, slightly constricted at primary septum.

On branches of *Pinus albicaulis* Engelm., western North America.

Material examined:

Idaho: *A. W. Slipp 584A* (type, MASS).

This species with its pulvinate ascocarps seems to be one of the primitive taxa of the genus. *D. wolfii* is closely related, has depressed globose ascocarps and broader ascospores.

Dothiora wolfii Barr, nom. nov. Figures 73–74.

≡ *Sphaerulina polyspora* Wolf, J. Elisha Mitchell Sci. Soc. 41: 97. 1925, *non Dothiora polyspora* Shear & Davidson, 1940 (*Sydowia dothideoides* Dearn. & Barth.).

Ascocarps 200–250 μ diam, 150–200 μ high, depressed globose, grouped at times in dark reddish brown areas on a branch, or scattered; wall 20–55 μ thick. Asci 55–70 × 12–14.5 μ, oblong, parallel from a flattened basal cushion of hyaline cells. Ascospores 17.5–22 × 4.5–6 μ, hyaline, narrowly obovate, tapered to obtuse ends, inequilateral to slightly curved, (2–)3–5-septate, constricted at primary septum.

On branches of *Oxydendrum arboreum* (L.) DC., North America.

Material examined:

North Carolina: Raleigh, Mar 1924, *F. A. Wolf* (type, BPI), 5 May 1924 (BPI).

Dothiora ribesia (Fr.) Barr, comb. nov. Figures 65–66.

≡ *Dothidea ribesia* Fr. Syst. Mycol. 2: 550. 1823.
≡ *Stromatosphaeria ribesia* (Fr.) Grev. Fl. Edinburgh 257. 1824.
≡ *Plowrightia ribesia* (Fr.) Sacc. Syll. Fungorum 2: 635. 1883.
≡ *Dothidella ribesia* (Fr.) Theiss. & Syd. Ann. Mycol. 13: 309. 1915.
≡ *Phragmodothella ribesia* (Fr.) Petrak, Ann. Mycol. 17: 62. 1919.
= *Dothidea irregularis* Otth, Mitt. Naturf. Ges. Bern 102. 1870.
≡ *Plowrightia irregularis* (Otth) Sacc. Syll. Fungorum 14: 680. 1899.

Ascocarps multiloculate, 500–1000 μ diam, rounded pulvinate, the surface plane; upper portion of locules protruding and roughening surface at times; ascocarps composed of vertically oriented rows of cells forming *textura globosa* to *textura prismatica,* blackened externally, often olivaceous to blackish internally, the hyphae penetrating host tissues; locules 60–80 μ diam, 70–100 μ high. Asci 60–72 × 11–12 μ. Ascospores 15–35 × 4.5–8(–14) μ, hyaline, light dull brown in age, narrowly obovate or elliptic (the ends obtusely pointed), straight to slightly curved, (1–)3–5-septate; no vertical septa formed.

On branches of *Ribes* spp., Europe, North America.

Material examined:

Maine: *Barr 3307* (MASS). Vermont: *Barr 4313, 4590* (MASS). South Dakota: *Griffiths, West Amer. Fungi 194.* Nebraska: *Fungi Columbiana 2621* (*Clathridium corticola* also present). Washington: Marysville, May 1926, *Grant* (MASS).

The aspect of *D. ribesia,* both immature and mature, accords well with that of *D. pyrenophora. D. ribesia* has been designated as the type species of *Plowrightia,* the hyaline-spored segregate from *Dothidea*. Petrak (1919) transferred *D. ribesia* to *Phragmodothella* because he found that the ascospores became three-septate. He speculated as to whether *P. kelseyi* (Ell. & Ev.) Theiss. & Syd. was identical with *P.*

ribesia. However, *P. kelseyi,* the type species of *Phragmodothella,* is a synonym of *Clathridium massarinum* (Sacc.) Berlese, and the genus *Phragmodothella* is synonymous with *Clathridium* (Müller & Loeffler 1958).

Dothiora asterinosporum (Ell. & Ev.) Sacc. and *D. platyasca* (Peck) Sacc. were both transferred to the genus in Sylloge Fungorum 8: 766. 1889. Neither species belongs in *Dothiora,* but are species of *Myriangium* instead. *D. asterinosporum* was transferred to *Myriangium* by Miller (1940) and again by Petrak (1959a). *D. platyasca,* according to type material from NYS (*Cenangium platyascum* Peck, Alabama), is identical with *M. duriaei* Mont. & Berk.

Saccothecium Fr. Summa Veget. Scand. 398. 1894.

= *Pringsheimia* Schulzer, Verh. Zool.-Bot. Ges. Wien 16: 57. 1866.
= *Pleosphaerulina* Pass. Atti Reale Accad. Lincei, Rendiconti Cl. Sci. Fis. IV, 7: 46. 1891.
= *Schizostege* Theiss. Ann. Mycol. 14: 415. 1916.

Ascocarps depressed globose, uniloculate, immersed beneath the epidermis, becoming erumpent, usually thickly scattered, the apex broadly rounded or short papillate; wall relatively thick, several layers of large thick-walled cells forming *textura angularis,* darkened externally; inner layers of compressed cells surrounding the locule; brown hyphae extending into plant tissues. Asci arising from a central column of hyaline or yellowish cells, oblong clavate, bitunicate, rounded at apex, tapered to a foot-like base. Ascospores overlapping bi- to triseriate in the ascus, hyaline, obovate or elliptic, several-septate, constricted at submedian primary septum, enlarged above, with vertical septum in one or several of mid cells, straight to inequilateral, the contents minutely guttulate; wall smooth.

On thin dead twigs, widespread.

Conidial state produced in culture: *Aureobasidium pullulans*-like: conidia hyaline or brownish, ovate, one-celled, budding from ascospores, other conidia, or from interior walls of small pycnidia (Brefeld, 1891; Klebahn, 1918; personal observation).

Wehmeyer (1957) discussed the generic names *Pringsheimia* and *Pleosphaerulina. Schizostege* Theiss. was based on Fuckel's *Sphaeria rosicola,* and was described as a genus of the Clypeosphaeriaceae with one-celled ascospores. Theissen's (1916) figures of this fungus leave no doubt that *S. rosicola* is only immature *Saccothecium sepincola.* Petrak and Sydow (1929) noted this fact, as did Clements and Shear (1931).

Phaeodothiora Petrak (1948) was described as a genus similar to *Saccothecium* but with dark olivaceous to blackish brown ascospores. The type and only species, *P. sinensis* Petrak, is extralimital.

Type species: *S. sepincola* (Fr.) Fr.

Saccothecium sepincola (Fr.) Fr. Summa Veget. Scand. 398. 1849. Figures 75–77.

≡ *Sphaeria sepincola* Fr. Syst. Mycol. 2: 498. 1823.
≡ *Sphaerulina sepincola* (Fr.) Starb. Bot. Not. 1890: 117; Bot. Centralbl. 46: 261. 1891.
≡ *Pleosphaerulina sepincola* (Fr.) Rehm in v.Höhnel, Ann. Mycol. 18: 96. 1920.
≡ *Pringsheimia sepincola* (Fr.) v.Höhnel, Ann. Mycol. 18: 97. 1920.
= *Pringsheimia rosarum* Schulzer, Verh. Zool.-Bot. Ges. Wien 16: 57. 1866.
= *Sphaeria rosicola* Fuckel, Symb. Mycol. 114. 1870.
≡ *Physalospora rosicola* (Fuckel) Sacc. Syll. Fungorum 1: 435. 1882.
≡ *Schizostege rosicola* (Fuckel) Theiss. Ann. Mycol. 14: 415. 1916.
= *Pleosphaerulina rosicola* Pass. Atti Reale Accad. Lincei, Rendiconti Cl. Sci. Fis. IV, 7: 46. 1891.

Ascocarps 140–180 μ diam, 120–150 μ high; wall 15–24 μ thick at sides and base, up to 33 μ thick over apex, of 3–5 layers of polygonal cells. Asci 33–60 × (12–)14.5–18.5 μ. Ascospores (15–)18–26.5 × 6–9 μ, hyaline, obovate, usually broadest above and tapered to an obtuse base, 3–7-septate, constricted at the primary septum, with a vertical septum in one or several of mid cells.

On thin twigs of various woody dicotyledons, especially *Cornus* and *Rosa,* widespread.

Material examined:

British Columbia: Sidney, April 1915, *J. Macoun* (DAOM, as *Sphaerulina intermixta*). Massachusetts: *Barr 4932, 5122* (MASS). New York: Hyde Park, 16 Feb 1969, *H. E. Ahles* (MASS). Michigan: *Barr 1000B* (MASS).

This fungus is not uncommon and has been given a number of names. It has been confused with another entity, *Clathridium corticola* (Fuckel) Shoemaker & Müller, which may occur on the same twigs. *C. corticola* has unitunicate asci produced in true perithecia. Rehm (1912) was apparently the first person to try to unravel the confusion surrounding the two different fungi. Von Höhnel (1920) and Petrak (1921) discussed in some detail the various names applied to the two species. Wehmeyer (1957) again elucidated the differences between the species and traced the history of various of the names. More details on *Clathridium corticola* are available in Shoemaker and Müller (1964).

Müller and von Arx (1950) and Kreisel (1969) placed *Saccothecium sepincola* (sub *Pringsheimia*) in the Dothioraceae and I too consider *Saccothecium* to belong in this family, rather than in the Dothideaceae where others have disposed of it. Certainly asci and ascospores, as well as wall structure, are very similar in members of *Dothiora* and *Saccothecium.* The peculiar columnar mass of cells from which asci arise in the base of the locule is in my interpretation an exaggeration of the slightly raised basal area found in *Dothiora pyrenophora, D. thujae,* and *D. taxicola.*

Dothideaceae Chev. Fl. Env. Paris 446. 1826; Nits. in Fuckel Symb. Mycol. 214. 1870, emend.
= *Sphaerellaceae* Winter in Rabenh. Kryptogamenfl. Deutschland 1(2): 334. 1887.
= *Mycosphaerellaceae* Lindau in Engler & Prantl, Natürl. Pflanzenfam. 1(1): 421. 1897.

Ascocarps uni- or multiloculate, globose, depressed, or conic, or large and rounded and irregular, immersed or erumpent, scattered or grouped, the apical pore small; wall of few layers of cells forming *textura intricata* or compressed and forming *textura prismatica,* dark externally, lighter to hyaline within; cells of multiloculate ascocarps often vertically oriented, forming *textura intricata,* locule walls thin and *textura prismatica.* Asci oblong or saccate, sometimes ovoid, bitunicate, arising from a low basal cushion and forming a fascicle in the locule, octosporous, the spores rarely fewer. Ascospores biseriate or crowded in the ascus, hyaline, yellowish, or brown, elliptic, obovate, fusoid, oblong, elongate or cylindric, one-celled or one- to several-septate, the position of the primary septum median or variable; globules or groups of minute guttules one or two per cell; wall smooth or roughened, occasionally surrounded by a gelatinous coating.

Conidial states various: Sphaeropsidales: *Selenophoma, Kabatia, Septoria, Lecanosticta.* Moniliales: *Ramularia, Ovularia, Cladosporium, Cercospora, Passalora, Polythrincium, Stigmina; Aureobasidium pullulans*-like conidia and hyphae may be produced in culture. Microconidial state: *Asteromella* (often in literature as *Phyllosticta*).

On dead or living leaves, stalks, fruits, or branches of herbaceous and woody dicotyledons, on leaves and culms of monocotyledons, leaves and cones of gymnosperms, and on ferns, lycopods, mosses, and algae; cosmopolitan.

The family Dothideaceae originally included a heterogeneous assemblage of genera, and has been divided and regrouped a number of times. Luttrell (1951b) outlined the history of the family, and united the family Mycosphaerellaceae with it. The latter, originally placed in the Sphaeriales, was transferred to the Pseudosphaeriales by Theissen and Sydow (1918), a position in which it has been retained by most authors. Miller (1938, 1941, 1949) placed the family in the Dothideales, while Luttrell (1951b) pointed

out that uni- and multiloculate ascocarps may occur in the same species and reduced the Mycosphaerellaceae to synonymy with the Dothideaceae.

The genus *Curreya* Saccardo was described in Sylloge Fungorum 2: 651. 1883 as a dictyosporous representative of the Dothideaceae. *C. conorum* (Fuckel) Sacc. and *C. excavata* (Cooke & Ell.) Sacc. were the original species in the genus. Petrak (1940) redescribed *C. conorum,* noted the presence of numerous narrow filiform branched paraphyses and of associated *Coniothyrium glomerulatum* Sacc. state, and transferred the species to *Cucurbitaria* in the Pleosporales. He considered *Curreya* to be a synonym of *Cucurbitaria,* a decision in which I tentatively concur. *Curreya excavata* (Cooke & Ell.) Sacc. on branches of *Magnolia* was described with locules in a stroma, and brown muriform ascospores in cylindric asci. Ellis and Everhart (1982) disclaimed knowledge of *Curreya excavata.* They noted that the specimens in NY were *Dothidea concaviuscula.* In the presumed type collection, i.e. that of *Dothidea excavata* (Newfield, New Jersey, March 1876, NY), I too found only ascocarps of *Scirrhia concaviuscula,* but in a collection from the same locality dated 1879 (NY as *Curreya excavata*) on the same sheet there are, in addition to the *Scirrhia,* grouped ascocarps in which the asci are cylindric and the ascospores brown and muriform. This fungus is surely a species of *Fenestella* near *F. minor* Tulasne. The name *Dothidea excavata* was based on the ascocarps and locules of one fungus and the ascospores and asci of another, and is an illegitimate name. Theissen and Sydow (1915) transferred *Dothidea excavata* to *Dictyodothis* and described ascocarps typical of *Dothidea concaviuscula* (i.e. *Scirrhia*). They noted that asci were in a fascicle in the locule, without paraphyses, and were not seen mature. Ascospore details were quoted from the literature. Other species transferred to *Curreya* at later dates must be disposed of in a number of other genera.

Key to Genera

1. Ascospores one-celled, hyaline. *Discosphaerina.*
1. Ascospores septate, hyaline or pigmented.
   2. Ascospores hyaline; septum inframedian and basal cell minute (apiospores). *Omphalospora.*
   2. Ascospores hyaline or pigmented, septum (a) median or supramedian.
      3. Ascospores light brown, septum supramedian.
         4. Ascocarps uniloculate, borne in hyphae attached to sides of superficial sclerotial ectostroma. *Lasiobotrys.*
         4. Ascocarps multiloculate, the locules marginal, horizontal or nearly so. *Rhizogene*
      3. Ascospores hyaline or pigmented, septum (a) median.
         5. Ascospores cylindric or filiform, several-septate, hyaline. *Sphaerulina.*
         5. Ascospores variable in shape, 1(−3)-septate, hyaline or pigmented.
            6. Ascospores hyaline, occasionally yellowish or brownish in age, variable in shape but not broadly elliptic; globules usually two in each cell. *Mycosphaerella.*
            6. Ascospores brown early in development, broadly elliptic; globule one in each cell. *Dothidea.*

Discosphaerina v.Höhnel, Sitzungsber. Kaiserl. Akad. Wiss. Math.-Naturwiss. Abt. 1, 126: 353. 1917.

Ascocarps uniloculate, black, often shining, immersed, scattered or grouped, often connected by thick hyphae and at times forming a crustose stromatic area, depressed globose, somewhat lens-shaped in section, rounded or occasionally elliptic in face view; wall thin, with two or three layers of large polygonal cells; apical pore small or irregularly shaped. Asci oblong, occasionally ovoid, bitunicate, relatively numerous in a broad fascicle, sessile or the base foot-like. Ascospores overlapping biseriate to triseriate in the ascus, hyaline, elliptic, obovate, oblong, or fusoid, one-celled; contents minutely guttulate; wall smooth, at times surrounded by a thin gelatinous coating.

Conidial state: *Selenophoma* Maire: Pycnidia dark, globose, similar in aspect to ascocarps; conidiophores as wall cells lining locule; conidia hyaline, one-celled, lunate or falcate (illustrated by Müller 1957). *Kabatia* Bubák: Pycnidia dark, depressed or hemis-

pherical, opening widely; conidiophores short, lining base of locule; conidia hyaline, ovoid or clavate, one-septate; upper cell broad, basal cell stalk-like, often curved or bent (illustrated by Müller 1953a). *Aureobasidium pullulans*-like conidia may be produced in culture (illustrated by Hudson 1966). Microconidial state: *Asteromella*: Pycnidia small, wall dark; conidiophores short, lining locule; conidia hyaline, minute, oblong, one-celled.

On overwintered leaves or stalks of herbaceous or woody dicotyledons, leaves or culms of monocotyledons, widespread.

The generic concepts of *Botryosphaeria, Guignardia,* and *Discosphaerina* and my interpretation of the taxa involved are discussed under the former genus.

Type species: *D. discophora* v.Höhnel.

Discosphaerina discophora v.Höhnel, Sitzungsber. Kaiserl. Akad. Wiss. Math.-Naturwiss. Kl. Abt. 1, 126: 353. 1917.

≡ *Guignardia discophora* (v.Höhnel) Petrak, Ann. Mycol. 19: 111. 1921.
= *Guignardia steppani* Petrak, Ann. Mycol. 18: 111. 1920.

Ascocarps 90–120 μ diam, 80 μ high, depressed globose, often connected by hyphae to form stromatic crusts; wall thin and 6–12 μ thick at base and lower sides, up to 25 μ thick toward apex. Asci 32–52 × 5–9 μ. Ascospores (6–)8–14 × 2.5–3(–4) μ, hyaline, fusoid, straight to inequilateral, biseriate in the ascus.

On overwintered leaves of *Solidago virgaurea* L., Europe.

No specimens identified as this fungus have been found as yet from North America. The description is derived from the literature and from extralimital specimens.

Additional species:

Discosphaerina fagi (Hudson) Barr, comb. nov. Figures 78–80.

≡ *Guignardia fagi* Hudson, Nova Hedwigia 10: 323. 1966.

Ascocarps 60–80 μ diam, 40–60 μ high, loosely grouped along sides of main leaf veins, epiphyllous, subcuticular; wall 8–10 μ thick, with one to two layers of dark brown cells. Asci 22–39 × 9–11 μ, oblong. Ascospores 9–15 × 2.5–3.5 μ, hyaline, fusoid, usually inequilateral, occasionally straight or slightly curved, at times with a delicate gelatinous coating, overlapping bi- to triseriate in the ascus.

Conidial state: *Aureobasidium pullulans*-like conidia and hyphae are produced in culture (Hudson 1966).

On overwintered leaves of various deciduous trees, Europe; *Acer saccharum* Marsh., North America.

Material examined:

Massachusetts: *Barr 2906* (MASS).

The collection cited has somewhat smaller asci and ascospores than those originally described. Hudson (1966) described the species from overwintered leaves of *Fagus sylvatica* and found it to occur on leaves of a number of other trees.

Discosphaerina boltoniae (Dearn. & Barth.) Barr, comb. nov.

≡ *Guignardia boltoniae* Dearn. & Barth. in Dearn. Mycologia 18: 245. 1926.

Ascocarps 70–120 μ diam, thickly scattered, connected by brown hyphae; wall thin, about 10 μ thick. Asci 57–60 × 15–18 μ, oblong. Ascospores 15–18 × 4.5–6 μ, hyaline, elliptic or fusoid, straight, overlapping biseriate in the ascus.

Conidial states: *Selenophoma* (*Macrophoma boltoniae* Dearn. & Barth.): Pycnidia similar to ascocarps; conidia 17–22 × 5–7 μ, hyaline, fusoid. Microconidial: *Asteromella* (*Phoma boltoniae* Dearn. & Barth.): Pycnidia 80 μ diam, similar to ascocarps; conidia 6–7.5 × 2–3 μ, hyaline, oblong, one-celled.

On stalks of *Boltonia diffusa* Ell., North America.

Material examined:

Oklahoma: Devol, 8 May 1923, *Bartholomew* (type, *Dearness Herb. 5762* in DAOM).

Discosphaerina tofieldiae (F. Tassi) Barr, comb. nov.

≡ *Laestadia tofieldiae* F. Tassi, Bull. Lab. Orto Bot. Reale Univ. Siena 4: 7. 1901.
≡ *Guignardia tofieldiae* (F. Tassi) v.Arx & Müller, Beitr. Kryptogamenfl. Schweiz 11(1): 59. 1954.

Ascocarps 50–70 μ diam, thickly scattered to grouped, connected by brown hyphae and blackening leaf surface; wall thin. Asci 28.5–40 × 9–11 μ, oblong, sessile. Ascospores 9–13 × 2–3.5 μ, hyaline, obovate oblong, straight, crowded in the ascus, the ends rounded.

On leaves of *Tofieldia* spp., Europe, North America.

Material examined:

Northwest Territories: *Bartlett 2722* (MICH).

Discosphaerina circumtegens (Rostr.) Barr, comb. nov.

≡ *Laestadia circumtegens* Rostr. Meddel. Grønland 3: 547. 1888.

Ascocarps 160–240 μ diam, 100–140 μ high, thickly scattered, with brown connecting hyphae; wall 15 μ thick, blackish brown. Asci 36–45 × 9–12 μ, oblong and sessile, or the base foot-like. Ascospores overlapping bi- to triseriate in th ascus, 10.5–13.5 × 3.5–6 μ, hyaline, oblong, straight to inequilateral (the ends rounded), at times surrounded by a thin hyaline gelatinous coating.

On *Erigeron filifolius* (Hook.) Nutt., Greenland , North America.

Material examined:

Washington: Wenatchee River valley, Leavenworth, 23 June 1933, *Hedgcock* (MASS).

Omphalospora Theiss. & Syd. Ann. Mycol. 13: 361. 1915.

= *Plectosphaerella* Kirschst. Kryptogamenfl. Mark Brandenburg 7(3): 310. 1938, *non* Klebahn 1931.
= *Plectosphaerina* Kirschst. Ann. Mycol. 36: 368. 1938.

Stromata crustose; ascocarps subcuticular, multiloculate or uniloculate and thickly grouped with connecting hyphae blackening substrate; cells of stromatic tissue arranged in vertically oriented rows, forming *textura angularis*; cells near margin forming *textura epidermoidea*; locule wall thin, of one or two layers of cells; pore small, apical. Asci ovoid or subglobose, few, bitunicate, sessile. Ascospores crowded in the ascus, hyaline, obovate, rounded and broad above, tapered to a pointed base, septate near base, not constricted at septum; contents with one or two globules in upper cell, one in lower cell; wall smooth.

Conidial state not known.

On leaves and stalks of herbaceous dicotyledons, widespread.

The generic name *Ascospora* Fries (Summa Veget. Scand. 425. 1849) has been applied by several authors to species of *Omphalospora.* Von Höhnel (1919b) detailed the history of *Ascospora.* The name must be rejected because it has been used in different senses and so has become a long-persistent source of error (Art. 69, International Code of Botanical Nomenclature).

Petrak (1940) discussed *Plectosphaerina* Kirschstein which replaced *Plectosphaerella* Kirschstein. The genus is taxonomically superfluous as the species included within it are congeneric with *Omphalospora stellariae.*

Type species: *O. stellariae* (Lib.) Theiss. & Syd.

Omphalospora stellariae (Lib.) Theiss. & Syd. Ann. Mycol. 13: 361. 1915. Figures 81–83.

≡ *Dothidea stellariae* Lib. Pl. Crypt. Arduenn. exs. n. 172. 1832.
≡ *Euryachora stellariae* (Lib.) Fuckel, Symb. Mycol. 220. 1870.
≡ *Phyllachora stellariae* (Lib.) Schroet. in Cohn, Kryptogamenfl. Schlesien 3(2): 471. 1894.
≡ *Dothidella stellariae* (Lib.) Lind, Ann. Mycol. 3: 428. 1905.

Stroma crustose, at times extending over entire leaf, 30–45 μ deep; locules 32–45 μ diam. Asci 15–21 × 9–10.5(–12) μ. Ascospores 9–11 × 2–3 μ; lower cell 1–2 μ wide and long.

On leaves and stalks of *Stellaria* spp., northern Europe, North America.

Material examined:

Alaska: *Jordal 2106* (MICH).

This species is the only representative of the genus which I have seen from North America. *Omphalospora* is closely related to *Euryachora* Fuckel. The type species of the latter genus, *E. sedi* (Fr.) Fuckel, blackens areas of stalks and leaves of *Sedum* spp. in Europe. The ascospores of *E. sedi* are septate in the middle, and this characteristic appears to be the major one distinguishing *Euryachora* from *Omphalospora.*

Mycosphaerella Johanson, Ofvers. Förh. Kongl. Svenska Vetensk.-Akad. 41: 163. 1884, *non* Saccardo 1891.

≡ *Sphaeria* Sect. *Sphaerella* Fr. Summa Veget. Scand. 395. 1894, *non Sphaerella* Sommerfelt 1824.
≡ *Sphaerella* (Fr.) Rabenh. Herb. Viv. Mycol. ed. 2, n. 264. 1856.
= *Septorisphaerella* Klebahn, Haupt- und Nebenfruchtformen der Askomyzeten 131. 1918.
= *Ramularisphaerella* Klebahn, Haupt- und Nebenfruchtformen der Askomyzeten 131. 1918.
= *Cercosphaerella* Klebahn, Haupt- und Nebenfruchtformen der Askomyzeten 132. 1918.
= *Didymellina* v.Höhnel, Ann. Mycol. 16: 66. 1918.
= *Ovosphaerella* Laibach, Centralbl. Bakteriol. Abth. 2, 53: 559. 1921; 55: 293. 1922.
= *Cymadothea* Wolf, Mycologia 27: 71. 1935.

Ascocarps uni- or multiloculate, immersed becoming erumpent, globose, conic, or depressed, scattered singly or grouped or connected by hyphae to form stromatic masses, at times as compact stromata containing several locules; apex plane or papillate, opening by small pore; wall thin to medium thick, of one to four layers of brownish black polygonal cells. Asci oblong, elongate, saccate, ovoid, or rarely short clavate, bitunicate, sessile or nearly so, numerous or few. Ascospores overlapping biseriate or crowded or in a fascicle in the ascus, hyaline, at times dull brownish in age, elliptic, obovate, oblong, fusoid, or elongate; septum nearly median, constricted or not; occasionally one or two secondary septa formed in age; globules usually two per cell; wall smooth, at times roughened in age, occasionally surrounded by a gelatinous coating.

Conidial states variable: *Septoria* Sacc.: Pycnidia globose or flask-shaped, the wall thin; conidiophores as cells of inner wall, short; conidia hyaline, elongate fusoid, straight or curved, one-celled to several-septate, the wall smooth (see von Arx 1970 for illustration).

Lecanosticta Syd.: Pycnidia as shallow open chambers in upper portion of stroma; conidiophores a compact hyaline basal layer of short cells; conidia brown, elongate fusoid, straight or curved or bent, one- to several-septate, the wall roughened in age. (Wolf and Barbour 1941 illustrate this state).

Ramularia Unger: Conidiophores single or clustered in a fascicle, arising from a stromatic base or vegetative hyphae or from apex of sterile ascocarps, hyaline or light brown, one-celled or septate, elongate, growing sympodially, the scars of conidia indistinct; primary conidium a terminus spore as blown-out end of conidiophore apex, often budding from apex to produce a chain of blastospores, branching at times, hyaline or brown, one-celled or several-septate, oblong, elongate, or fusoid; wall

smooth. (*Didymaria* Corda was segregated from *Ramularia* by the one-septate conidia.) In *Ovularia* Sacc. the primary conidia do not produce blastospores. *Ramularia* and *Ovularia* are illustrated by von Arx (1970).

Cladosporium Link ex Fries: Conidiophores single or in a fascicle from vegetative hyphae or from stromatic base, brown, septate, elongate, growing sympodially, often denticulate, bearing distinct conidial scars; conidia hyaline or brown, terminal, single or in short to long simple or branched chains of blastospores, one-celled to several-septate, oblong, elliptic, or subglobose; wall smooth or roughened. *Heterosporium* Cooke has been segregated from *Cladosporium* for species with conidia several-septate. De Vries (1952) considered *Heterosporium* a synonym of *Cladosporium.* He illustrated a number of species. *Scolicotrichum* has been utilized; the name is a nomen confusum according to Hughes (1958).

Cercospora Fres.: Conidiophores single or in a fascicle, arising from stromatic base or vegetative hyphae or from apex of sterile ascocarps, hyaline to brown, one-celled or septate, oblong, straight or curved, smooth or denticulate; scars of conidia often distinct; conidia (blastospores) pigmented, elongate fusoid to nearly cylindric, straight or curved, one-celled or septate, terminal, single, becoming lateral by sympodial development of the conidiophore; wall smooth. *Cercosporella* Sacc. has hyaline conidia. *Isariopsis* Fr. in Sacc. is also similar to *Cercospora* but the conidiophores are closely connected to form a synnema. (Illustrated by Chupp 1953).

Passalora Fr.: Much as in *Cercospora;* conidia one-septate, nearly cylindric. *Cercosporidium* Earle has been segregated from *Passalora.* (Illustrated by Deighton 1967).

Polythrincium Kunze ex Fr.: Conidiophores in fascicles from stromatic base, dark brown, one-celled or septate, wavy in outline, growing sympodially, geniculate; conidial scars distinct; conidia terminal blastospores, single, elliptic to obovate, brown, one-septate; wall roughened. (Wolf 1935 illustrated *P. trifolii*).

Stigmina Sacc.: Conidiophores in a fascicle from stromatic base, emerging through stomata of the host tissue, brown, septate, annellophores; conidia ovate, elliptic or oblong annellospores, brown, one- to several-septate; wall roughened at times (*S. platani* was illustrated by Wolf 1938). Microconidial state: *Asteromella* Pass. & Thümen (often referred to in the literature as *Phoma* or *Phyllosticta*; Müller and von Arx (1962) noted that *Stictochorella* v.Höhnel and *Plectophoma* v.Höhnel were identical with *Asteromella.*) Uniloculate or multiloculate pycnidia lined by hyaline cells which produce minute microconidia (spermatia), these hyaline, oblong, one-celled.

On overwintered leaves, stalks, fruits, or twigs of many dicotyledonous plants, on monocotyledons, ferns, gymnosperms, mosses, algae, occasionally parasitic, cosmopolitan.

The generic synonymy is probably incomplete. Klebahn's and Laibach's names were to designate those species of *Mycosphaerella* which had a particular conidial state. *Didymellina* is retained at subgeneric level, although arguments for separating the species from those of *M.* subgenus *Mycosphaerella* do have merit. *Cymadothea* was reduced to synonymy with *Mycosphaerella* by Petrak (1941).

The genus *Mycosphaerella* is rich in species—though probably not as many exist as published descriptions would suggest. Details of subdivision of the genus and of the relative merits of many species of *Mycosphaerella* have not been worked out yet. I present here a tentative outline of classification. Two subgenera are recognized as distinct by the shape of the asci and the conidial states. Perhaps two distinct genera are represented, as has been suggested in the past; for the present all the taxa are retained under *Mycosphaerella.* Each subgenus is further divided into several sections based on ascospore type and/or habit. These taxonomic groups are delimited in a key. Within each section groups of species can be recognized, which I am designating as series but for which I have not provided names. The species described within a series include the one which typifies the series and usually one or more in addition.

Key to Subgenera and Sections

1. Asci numerous in a fascicle, oblong, elongate, or clavate; ascospores overlapping biseriate or in a fascicle in the ascus; conidial state belonging to *Septoria, Lecanosticta, Ramularia, Cercospora,* or variants. Subg. *Mycosphaerella.*
   2. Ascospores fusoid or elliptic fusoid; ends pointed.
      3. Ascocarps parasitic, maturing in spots in living leaves; spots usually limited by a marginal zone. Sect. *Plaga.*
      3. Ascocarps saprobic, maturing in overwintered leaves or stalks.
         4. Ascospores elongate; length to width ratio more than 6:1 Sect. *Longispora.*
         4. Ascospores shorter; length to width ratio less than 6:1. Sect. *Caterva.*
   2. Ascocarps obovate, oblong, or elliptic; ends rounded.
      5. Ascocarps parasitic, maturing in spots in living leaves; spots usually limited by a marginal zone. Sect. *Macula.*
      5. Ascocarps saprobic, maturing in overwintered leaves or stalks. Sect. *Mycosphaerella.*
1. Asci relatively few in a fascicle, saccate, ovoid, or broadly oblong; ascospores crowded in the ascus; conidial state belonging to *Cladosporium, Passalora, Polythrincium, Stigmina,* or variants. Subg. *Didymellina.*
   6. Ascospores fusoid; ends pointed. Sect. *Fusispora.*
   6. Ascospores obovate; ends rounded.
      7. Conidial state conspicuous, causing leaf blotches.
         8. Conidial state *Polythrincium,* sympodiosporous. Sect. *Cymadothea.*
         8. Conidial state *Stigmina,* annellosporous. Sect. *Stigmina.*
      7. Conidial state not so conspicuous.
         9. Ascocarps parasitic, maturing in spots in living leaves; spots usually limited by a marginal zone. Sect. *Didymellina.*
         9. Ascocarps saprobic, maturing in overwintered leaves or stalks. Sect. *Tassiana.*

Subgenus **Mycosphaerella.**

Asci oblong, elongate, occasionally clavate, numerous in a broad fascicle arising from low basal layer of small cells. Macroconidial state variable.

Section **Mycosphaerella.**

Ascocarps saprobic; ascospores obovate, oblong, or elliptic; ends rounded.
Lectotype species: *M. punctiformis* (Pers. ex Fr.) Starb.

1. Series of *M. punctiformis*: Ascospores small, (6.5–)8–13(–14) × 2–4 μ.

Mycosphaerella punctiformis (Pers. ex Fr.) Starb. Bihang Kongl. Svenska Vetensk.-Akad. Handl. 15, afd. III, n. 2: 9. 1889; Schroet. in Cohn, Kryptogamenfl. Schlesien 3(2): 333. 1894. Figures 84-86.

≡ *Sphaeria punctiformis* Pers. ex Fr. Syst. Mycol. 2: 525. 1823.
≡ *Sphaerella punctiformis* (Pers. ex Fr.) Rabenh. Herb. Viv. Mycol. ed. 2, n. 264. 1856.
≡ *Ramularisphaerella punctiformis* (Pers. ex Fr.) Klebahn, Ber. Deutsch. Bot. Ges. 36: General Versamml. 57. 1919.
= *Sphaeria maculaeformis* Pers. ex Fr. Syst. Mycol. 2: 524. 1823.
≡ *Sphaerella maculaeformis* (Pers. ex Fr.) Auersw. in Gonnerm. & Rabenh. Mycol. Eur. 5/6: 5. 1869.
≡ *Mycosphaerella maculaeformis* (Pers. ex Fr.) Schroeter in Cohn, Kryptogamenfl. Schlesien 3(2): 333. 1894.

Ascocarps immersed becoming erumpent, scattered or grouped, connected by hyphae at times, usually hypophyllous, globose or depressed, 60–115 μ diam, the apex papillate. Asci 27–40(–50) × 5–8 μ oblong. Ascospores (6.5–)8–13(–14) × 2–4 μ, hyaline, minutely guttulate, oblong or obovate, straight, rarely inequilateral; upper cell broader and slightly shorter than lower.

Conidial state: *Ramularia*: Conidia 4–20 × 2–3.5 μ, hyaline, oblong, one-celled, forming chains of blastospores.

On overwintered leaves of various deciduous trees and shrubs, cosmopolitan.

This species is extremely common and may be found on a great variety of overwintered leaves. Several forms and varieties have been based on different host plants. Variations in such characters as grouped or scattered ascocarps and size range of ascospores have been utilized to erect a number of species. Although *M. punctiformis* may be a collective name for several entities, the name is retained at least until more evidence is available.

Additional species:

Mycosphaerella millepunctata (Desm.) Barr, Mycologia 62: 382. 1970.

For synonyms of this species see Barr (1970).

Ascocarps mostly epiphyllous, thickly scattered, 80–90 μ diam, the apex bluntly conic; wall thick, 10–13 μ thick at base, up to 18 μ near apex. Asci 30–40 × 4.5–6 μ. Ascospores 7.5–9 × 2.5–3 μ, hyaline, oblong, straight; upper cell not distinctly broader than lower.

On overwintered dead leaves of *Rhododendron* spp., Europe, North America.

Material examined:

Europe: *Desm. Pl. Crypt. 91* (isotype); *Westendorp Herb. Crypt. 468* (both as *Dothidea millepunctata,* NY). North America: North Carolina: Roan Mt., 28 July 1889, *Scribner* (on specimen of *Hendersonia concentrica,* NY). Virginia: Mountain Lake Biological Station, 11 July 1969, *C. Wolfe* (MASS).

Mycosphaerella pseudomaculaeformis (Desm.) Schroet. in Cohn, Kryptogamenfl. Schlesien 3(2):337. 1894.

≡ *Sphaeria pseudomaculaeformis* Desm. Ann. Sci. Nat. Bot. III, 6: 83. 1846.
≡ *Sphaerella pseudomaculaeformis* (Desm.) Auersw. in Gonnerm. & Rabenh. Mycol. Europ. 5/6: 12. 1869.

Ascocarps 60–96 μ diam, globose to depressed, grouped and forming small dark spots, mostly hypophyllous; wall thin. Asci 22–30 × 6.5–7.5 μ. Ascospores 7.5–10 × 2–2.5 μ, hyaline, elliptic or obovate, straight to slightly curved.

Conidial state: *Ramularia:* (*Ovularia bulbigera* (Fuckel) Sacc., *Scolicotrichum bulbigerum* Fuckel). Conidia 9–11 μ diam, globose, hyaline, one-celled.

On overwintered leaves of *Sanguisorba* spp., Europe, North America.

Material examined:

Newfoundland: Wild's Bight, 17 Aug 1859, *Wilce* (MASS).

Mycosphaerella scirrhoides Barr, nom. nov.

≡ *Scirrhia lineata* Dearn. & House, Circ. New York State Mus. 24: 31. 1940 (without Latin diagnosis).

Stromata usque ad 2 mm longa, loculo 50–72 μ diametro. Asci 33–45 × 9–10.5 μ. Ascosporae 9–11 × 3 μ, hyalinae, obovatae, uniseptatae.

Specimen typicum in folius emortuis *Caricis strictae,* prope "Carey Pond, 4th Lake, Herkimer Co., New York, 9 Aug 1917," legit *H. D. House*; in Herb. New York State Museum depositum.

Stromatic complexes up to 2 mm long, composed of loosely grouped brown hyphae surrounding locules, immersed erumpent; locules 50–72 μ diam, connected at sides; wall thin. Asci 33–45 × 9–10.5 μ. Ascospores 9–11 × 3 μ, hyaline, obovate, tapered evenly to base, straight.

On overwintered leaves of *Carex stricta* Lam., North America.

Material examined:

New York: Carey Pond, 4th Lake, Herkimer Co., 9 Aug 1917, *House* (NYS, type).

The type specimen is sparse, but as the name is in the literature, a Latin diagnosis is provided to validate it. The new name *Mycosphaerella scirrhoides* is proposed to

avoid confusion with *Mycosphaerium lineatum* Clements, Bull. Torrey Bot. Club 30: 84. 1903.

2. Series of *M. cassiopes*; Ascospores medium-sized, 12–16 × 3–4.5 μ.

Mycosphaerella cassiopes Barr, Contr. Inst. Bot. Unit. Montréal 73: 14. 1959.

Barr (1959) described and illustrated the species from northern North America. It is also found in northern Europe.

Sect. **Macula** Barr, sect. nov.

In foliis vivis; ascosporae obovatae, oblongae, vel ellipticae, extremitatibus rotundatis.

Species typicum: *M. chimaphilae* (Ell. & Ev.) v.Höhnel.

Parasitic; ascocarps developing and maturing in spots in living leaves; spots usually limited by a marginal zone; ascospores obovate, oblong, or elliptic, the ends rounded.

1. Series of *M. chimaphilae:* Ascospores small, 7.5–13 × 2–3.5 μ.

Mycosphaerella chimaphilae (Ell. & Ev.) v.Höhnel, Sitzungsber. Kaiserl. Akad. Wiss. Math.-Naturwiss. Kl. Abt. 1, 126: 355. 1917. Figures 87–89.

Leaf spots 1–10 mm wide, on the upper leaf surface reddish brown, the margin indistinct, lighter brown; spots on lower surface light brown with dark brown or reddish brown margin; ascocarps amphigenous, 75–135 μ diam, globose depressed, immersed to erumpent; apex rounded, depressed at times when dried; wall relatively thick. Asci 30–51 × 7–9.5 μ. Ascospores 9–13 × 2–3 μ, hyaline, narrowly obovate, straight to inequilateral.

On leaves of *Chimaphila umbellata* (L.) Bart. var. *cisatlantica* Blake, *Pyrola secunda* L., North America.

Material examined:

Ontario: *TRTC 4250* (MICH). New York: Cooperstown Junction, June, *Peck* (type of *M. chimaphilae* Peck, NYS). Michigan: *Povah Fp604* (MICH).

Parmelee (1958) discussed the synonymy of this species, which was described twice in the same year. He is of the opinion that the North American specimens are identical with *Sphaeria pyrolae* Fries, from Europe. Because of confusion over the identity of the latter name Parmelee preferred to use the North American one which is authenticated by a type specimen.

Mycosphaerella clintoniana (House) House, Bull. New York State Mus. 233–234: 26. 1921.

≡ *Sphaerella clintoniana* House, Bull. New York State Mus. 205–206: 40. 1919.
≡ *Sphaerella rhododendri* Cooke, J. Bot. 21: 108. 1883, *non* de Not. 1863.

Leaf spots extending from tip and sides toward middle, brown, grayish at times, the margin dark brown, slightly raised; ascocarps epiphyllous, 70–100 μ diam, globose, immersed erumpent, in small groups; wall thin. Asci 27.5–44 × 5.5–9 μ. Ascospores 7.5–10 × 2–3.5 μ, hyaline, oblong, straight.

On leaves of *Rhododendron* spp., Europe, North America.

Material examined:

Europe: *Sydow, Mycotheca March. 4423; Roumeguere, Fungi Gallici exs. 2744; Vize, Micro-Fungi Brit. 299.* North America: Oregon: Rhododendron, 5 Nov 1930, *Hansbrough* (all as *Sphaerella rhododendri* Cooke, NY).

2. Series of *M. arbuticola:* Ascospores medium-sized, 11–21 × (2.5–)3–5(–6) μ.

Mycosphaerella arbuticola (Peck) Barr, comb. nov.

≡ *Sphaerella arbuticola* Peck, Bull. Torrey Bot. Club 10: 75. 1883.

Leaf spots 2–8 mm diam, brown with dark brown raised margin; ascocarps 75–128 μ diam, globose, epiphyllous, scattered or grouped; wall thin. Asci 40–58 × 9–13 μ. Ascospores 13.5–19 × 3.5–5 μ, hyaline, elliptic or narrowly obovate, straight to slightly curved, obliquely uniseriate or biseriate in the ascus.

On leaves of *Arbutus menziesii* Pursh, western North America.

Material examined:

Washington: Seattle, June 1892, *Piper* (NYS). California: Santa Cruz, July, *Pringle* (type of *S. arbuticola,* NYS); *Ell. & Ev. N.A.F. 1682.*

Ellis and Everhart (1892) included *Sphaerella umbellulariae* Cooke and Harkness as a synonym of *Sphaerella arbuticola. S. umbellulariae* differs from the latter species in having hypophyllous ascocarps and in the pointed basal end of the ascospores. The host genera are from two different orders also. Until inoculation experiments prove the connection, I prefer to recognize two species.

Mycosphaerella pachystimae Dearness, Mycologia 18: 246. 1926.

Leaf spots 2–5 mm wide, gray with raised brown margin; ascocarps 100–140 μ diam, globose or conic, mostly epiphyllous, scattered; wall thin. Asci 51–66 × 10.5–15 μ, often appearing too large for the mature ascospores and much residual cytoplasm remaining. Ascospores 15–21 × 4.5–6 μ, hyaline, elliptic, straight to inequilateral, or the lower cell bent.

On *Pachystima myrsinites* (Pursh) Raf., western North America.

Material examined:

Idaho: Coolin, 27 July 1924, *Boyce* (type, *Dearness Herb. 5667* in DAOM).

Mycosphaerella impatientis (Peck & Clinton) House, Bull. New York State Mus. 233–234: 28. 1921.

≡ *Sphaerella impatientis* Peck & Clinton, Annual Rep. New York State Mus. 30: 67. 1878.

Leaf spots reddish brown to dull brown, angular, not distinctly margined; ascocarps 52–182 μ diam, globose, mostly hypophyllous, thickly grouped; wall thin. Asci 22–50 × 8–12.5 μ. Ascospores 11–14.5(–16) × 2.5–3.5(–5) μ, hyaline, elliptic or obovate, inequilateral to slightly curved.

Conidial state: *Septoria:* Pycnidia 90–210 μ diam, amphigenous; conidia 19–28 × 1.5–2 μ, hyaline, filiform, 0–1-septate, curved.

On *Impatiens capensis* Meerb., *I. pallida* Nutt., eastern North America.

Material examined:

New York: Buffalo, June, *Clinton* (type, NYS); *Thümen, Mycotheca univ. 963.* Michigan: Ann Arbor, 3 July 1890, *Spalding, Newcombe,* two packets (MICH).

The pycnidia of the *Septoria* resemble ascocarps and the two states are intermingled on the same spots.

Sect. **Caterva** Barr, sect. nov.

In foliis et caulibus emortuis; ascosporae fusoideae, extremitatibus acutis.

Species typicum: **M. dearnessii** Barr.

Saprobic; ascospores fusoid, the ends pointed.

1. Series of *M. dearnessii*: Ascospores small, 10–14 × 2–3.5 μ.

Mycosphaerella dearnessii Barr, nom. nov. Figures 94–95.

≡ *Oligostroma acicola* Dearn. Mycologia 19: 251. 1926, not *M. acicola* (Cooke & Harkn.) Lindau (1897).

≡ *Scirrhia acicola* (Dearn.) Siggers, Phytopathology 29: 1076. 1939.
≡ *Systremma acicola* (Dearn.) Wolf & Barbour, Phytopathology 31: 70. 1941.

Ascocarps multiloculate, elliptic, 285–400 μ long or up to 2.5 mm long by confluence, 78–110(–300) μ wide, up to 190 μ high, immersed erumpent; locules 49–80 μ diam, often in a single row. Asci (30–)35–42 × 6–9 μ. Ascospores 9–14(–16) × 2.5–3(–4) μ, hyaline, fusoid, straight to inequilateral.

Conidial state: *Lecanosticta acicola* (Thüm.) Syd.: Stromata elongate, erumpent, the locules opening widely, the bases lined with short hyaline conidiophores; conidia 20–28 × 2.5–3 μ, brown, elongate, tapered at apex, blunt at base, 3-septate, bent, the wall roughened. Microconidial state: locules in immature stromata contain microconidia, these hyaline, 2–3 × 1 μ, 1-celled.

On leaves of *Pinus* spp., North America, Europe.

Material examined:

Ohio: Waterloo State Forest, Athens Co., 26 Feb 1936, *Green* (BPI). Iowa: 1949 (BPI). Kansas: Oswego, Labette Co., 1 Apr 1952, *King* (BPI). North Carolina: Durham, 20 Apr 1940, *Wolf* (BPI, NY); Duke Forest, Durham, Feb 1937, *Hartley* (BPI). Missouri: Nov 1944, *Bretz* (BPI). South Carolina: Hampton Co., Aug 1941, *Allen* (BPI). Arkansas: Fordyce, 19 May 1929, *Chapman* (BPI). Alabama: Conecuh Nat. For., 27 Sept 1937, *Lamb* (BPI); Citronella, 12 Mar 1946, *Pfaffman* (BPI). Mississippi: Brooklyn, 11 Mar 1941, *Siggers* (BPI). Louisiana: Chapman Forest, Urania, 9 Mar 1939, *Siggers* (BPI); Woodworth, 28 Jan 1939, *Siggers* (BPI); 28 Jan 1938 (BPI); Bogalusa, 12 Feb. 1941, *Siggers* (BPI); 14 Feb 1939 (PBI). Texas: Rusk, 9 May 1938, *Young* (BPI). Florida: Gainesville, Alachua Co., 6 Feb 1944, *Rhoads* (BPI); Camp Pinchot, 10 Sept 1938, *Siggers* (BPI).

The generic disposition of this species has been puzzling to all who worked with it. Siggers (1939, 1944), Wolf and Barbour (1941) and Wolf and Wolf (1947) argued about the position of the fungus. They followed the original separation of the Phyllachoraceae and Dothideaceae by Theissen and Sydow (1915), based on insertion of the ascocarp. Petrak (1962) in his description of the disease from Austria stated that *Scirrhia acicola* was neither *Scirrhia* nor *Oligostroma* nor typical *Systremma* and suggested that more study of the species was needed. When one recognizes the variability and possible intergradation between single ascocarps, grouped ascocarps, and multiloculate ascocarps, use of this character as a generic one becomes impossible. Then locule and ascus development are of paramount importance in the assignment of this species to the Dothideaceae. All characters accord well with *Mycosphaerella* subgenus *Mycosphaerella.* The *Lecanosticta* conidial state seems to be not far from *Septoria,* species of which are associated with other species of *Mycosphaerella* in the subgenus and section.

Mycosphaerella caulicola (Karst.) Lind, Danish Fungi 208. 1913.

≡ *Sphaerella caulicola* Karst. Mycol. Fenn. 2: 169. 1873.

Ascocarps 90–200 μ diam, depressed globose, thickly grouped and forming elongate blackened areas on stalks, immersed, connected by brown hyphae; wall thin. Asci 35–50 × 6–9.5 μ. Ascospores 10.5–12 × 2.5–3.5 μ, hyaline, narrowly obovate, fusoid, tapered to base, straight or inequilateral.

On overwintered stalks of herbaceous plants, Europe, North America.

Material examined:

Europe: *Rehm Ascomyceten 648b.* Quebec: *Barr 2022* (DAOM, MASS). Ontario: *Ell. & Ev. N.A.F. 2538* (as *Sphaerella monardae* Ell. & Ev. n.s. ined.).

2. Series of *M. populorum:* Ascospores medium-sized, (9–)12–18(–21) × 2.5–4(–5) μ.

Mycosphaerella populorum G. E. Thompson, Phytopathology 31: 246. 1941. Figures 96–97.

Ascocarps globose or conic, 55–144 μ diam, scattered or thickly grouped and forming small blackened areas, amphigenous; wall thin. Asci 35–58(–70) × (9–)11–16 μ. Ascospores (12–)15–21(–28) × (3.5–)4.5–5(–6) μ, hyaline, fusoid or narrowly elliptic, straight to slightly curved.

Conidial state: *Septoria musiva* Peck: Pycnidia 48–120 μ diam; conidia 28–54 × 3.5–4 μ, hyaline, cylindric, 1–4-septate. Microconidial state: Pycnidia 48–80 μ diam; conidia 4–6.5 × 1.5 μ, hyaline, 1-celled, oblong (Thompson 1941).

On overwintered leaves of *Populus balsamifera* L. and other species of *Populus,* eastern North America.

Material examined:

Ontario: *DAOM 5130* (MICH). Massachusetts: *Barr 3207* (MASS). Michigan: *Barr 741* (MASS).

Mycosphaerella spleniata (Cooke & Peck) House, Bull. New York State Mus. 233–234: 30. 1921.

≡ *Sphaerella spleniata* Cooke & Peck, Annual Rep. New York State Mus. 25: 105. 1873.

Ascocarps 90–135 μ diam, globose or conic, hypophyllous, thickly grouped and forming blackish blotches; wall thin. Asci 48–72 × 7–9.5 μ. Ascospores (9–)14–17.5 × 2.5–3.5 μ, hyaline, elliptic with fusoid ends, straight to inequilateral.

On overwintered leaves of *Quercus* spp., North America.

Material examined:

New York: N. Greenbush, June, *Peck* (type, NYS); *Thümen, Mycotheca univ. 647.* Kansas: *Ell. & Ev. N.A.F. 3110.* Colorado: *Fungi Columbiani 3878.*

Mycosphaerella caricis (Dearn. & House) Petrak & Sydow, Ann. Mycol. 22: 383. 1924.

≡ *Laestadia caricis* Dearn. & House, Bull. New York State Mus. 205–206: 52. 1918.
≡ *Guignardia caricis* (Dearn. & House) Dearn. & House, Bull. New York State Mus. 266: 73. 1925.

Ascocarps 100–130 μ diam, globose, grouped; wall thin. Asci 33–45 × 9–10.5 μ. Ascospores 12–15 × 3–4 μ, hyaline, fusoid, inequilateral.

On overwintered leaves of *Carex stricta* Lam., eastern North America.

Material examined:

New York: Carey pond, Herkimer Co., 9 Aug 1917, *House* (type, NYS).

Mycosphaerella melanoplaca (Desm.) Lindau, in Engler & Prantl, Natürl. Pflanzenfam. 1(1): 424: 1897.

≡ *Sphaeria melanoplaca* Desm. Ann. Sci. Nat. Bot. III, 18: 364. 1852.
≡ *Sphaerella melanoplaca* (Desm.) Auersw. in Gonnerm. & Rabenh. Mycol. Eur. 5/6: 13. 1869.

Ascocarps 90–150 μ diam, depressed globose, scattered or grouped, with brown connecting hyphae; wall thin. Asci 38.5–50(–55) × 6.5–9 μ. Ascospores 12–18 × 2.5–3.5 μ, hyaline, fusoid, straight or slightly curved.

On overwintered leaves and stalks of *Alchemilla, Geum,* and *Potentilla*, Europe, North America.

Material examined:

Massachusetts: *Barr 3199* (MASS). Michigan: Ann Arbor, 21 May 1925, *Kauffman* (as *Dothidea potentillae,* MICH).

Mycosphaerella campanulae (Ell. & Kell.) Petrak, Hedwigia 65: 227. 1925 (as *Mycosphaerella* Ell. & Kell.).

≡ *Sphaerella campanulae* Ell. & Kell. Amer. Naturalist 17: 1166. 1883.

Ascocarps 104–160 μ diam, globose or slightly depressed, thickly scattered, with connecting brown hyphae; wall thin. Asci 32–48 × 8 μ. Ascospores 11–16 × 3–4 μ,

narrowly obovate fusoid, straight or inequilateral.

On *Campanula* spp., North America, Europe.

Material examined:

Ohio: *Ell. & Ev. N.A.F. 1683.*

Mycosphaerella cruciferarum (Fr.) Lindau in Engler & Prantl, Natürl. Pflanzenfam. 1(1): 424. 1897.

≡ *Sphaeria cruciferarum* Fr., Syst. Mycol. 2: 525. 1823.
≡ *Sphaerella cruciferarum* (Fr.) Sacc. Michelia 2: 315. 1878.
≡ *Carlia cruciferarum* (Fr.) v.Höhnel, Ber. Deut. Bot. Ges. 36: 314. 1918.

Ascocarps (45–)75–120 μ diam, depressed globose, grouped and connected by brown hyphae; wall thin. Asci 36–54 × 9–16 μ. Ascospores 10.5–13.5(–18) × 3–5.5 μ, hyaline, fusoid, straight or curved.

On overwintered stalks of Cruciferae, Europe, North America.

Material examined:

Europe: *Sydow Mycotheca germ. 1231.* Canada: Northwest Territories: Head of Clyde Inlet, Baffin Island, 27 June 1950, *Dansereau* (DAOM, MASS). Quebec: McClelan Strait, 19 July 1955, *Wilce* (DAOM, MASS).

3. Series of *M. ranunculi:* Ascospores large, 15–25(–36) × 2.5–5(–6) μ.

Mycosphaerella ranunculi (Karst.) Lind, Meddel. Grønland 71: 167. 1926. Figures 100–102.

≡ *Sphaerella ranunculi* Karst. Fungi Spetsb. n. 50, 105. 1872.
= *Sphaerella innumerella* Karst. Mycol. Fenn. 2: 182. 1873.
≡ *Mycosphaerella innumerella* (Karst.) Starb. Bih. Kongl. Svenska Vetensk.-Akad. Handl. 15, Afd. III, no. 2: 9. 1889.
= *Sphaerella fusispora* Fuckel, Reis. nach Nordpolarmeer 318. 1874.
= *Sphaerella fusispora* var. *groenlandica* Allescher, Biblioth. Bot. 42: 46. 1897.

Ascocarps 80–150 μ diam, globose or short conic, shining black, scattered to grouped, with brown connecting hyphae; wall relatively thin. Asci 37–67 × (6.5–)11–21 μ. Ascospores 16.5–24(–27) × (2.5–)3–5.5 μ, hyaline, clavate fusoid, inequilateral or slightly curved.

On overwintered leaves and stalks of *Geum, Potentilla, Ranunculus, Cassiope,* widespread in northern regions.

Material examined:

Europe: *Krieger, Fungi sax. 1773; Plowright Sphaer. Brit. 98; Rehm Ascomyceten 2015;* Abisko, Sweden, July 1930, *Lind* (MICH), all as *Sphaerella innumerella.* Northwest Territories: Head of Clyde Inlet, Baffin Island, 1 July and 4 Aug 1950, *Dansereau* (DAOM, MASS). Quebec: McClelan Strait, 20 July 1955, *Wilce* (DAOM, MASS). New Hampshire: *Barr 3855, 3965A, 4095B* (MASS). Oregon: Chimney Lake, Wallowa Co., 21 July 1950, *Kruckeberg* (MASS).

M. ranunculi and *M. taraxaci* are both species of subarctic and subalpine habitats. Both have shining black ascocarps which may be grouped and often connected by brown hyphae, and fusoid elongate ascospores. I differentiate two species on the basis of ascus shape, which is oblong in *M. ranunculi* and broadly oblong approaching saccate in *M. taraxaci.* Ascospores of *M. ranunculi* are relatively narrower than those of *M. taraxaci*; in *M. ranunculi* the ascospores are overlapping biseriate in the ascus whereas in *M. taraxaci* they are more crowded.

Mycosphaerella taraxaci (Karst.) Lind, Rep. Sci. Res. Norwegian Exped. Nov. Zeml. 1921. 19: 11. 1924.

≡ *Sphaerella taraxaci* Karst. Hedwigia 11: 186. 1872.

Ascocarps 80–150 μ diam, globose conic, hypophyllous or epiphyllous, immersed erumpent, rather shining black, scattered thickly or grouped to form black blotches, with brown connecting hyphae in the plant tissues; wall relatively thick (10–17 μ), the cells large and dark brown. Asci (33–)40–56(–72) × 11–20 μ. Ascospores 16–21(–24) × (3.5–)4–5.5(–6) μ, hyaline, clavate fusoid, straight or slightly curved.

On *Taraxacum, Erigeron, Aster, Phyllodoce,* widespread in northern regions.

Material examined:

Europe: Taimyr, July 1843, *Lind* (MICH). Northwest Territories: Ellesmere Island, 5 Aug 1955, *Schuster*; Head of Clyde Inlet, Baffin Island, *Dansereau,* several collections. Quebec: Port Burwell, 30 July 1955, *Wilce* (all DAOM, MASS). British Columbia: *Barr 628,* on *Phyllodoce* (MASS). Washington: *Simmons 2351* (MICH).

Mycosphaerella oenotherae (Ell. & Ev.) Lindau in Engler & Prantl, Natürl. Pflanzenfam. 1: 424. 1897.

≡ *Sphaerella oenotherae* Ell. & Ev. J. Mycol. 1: 151. 1885.
= *Sphaerella granulata* Ell. & Ev. J. Mycol. 2: 102. 1886.
≡ *Mycosphaerella granulata* (Ell. & Ev.) Lindau in Engler & Prantl, Natürl. Pflanzenfam. 1(1): 424. 1897.

Ascocarps 88–175 μ diam, depressed globose, thickly scattered to grouped, with brown connecting hyphae, forming dark blotches at times; wall thin. Asci 35–60(–86) × 8–11 μ. Ascospores 15–25.5 × 2.5–3.5(–5) μ, hyaline, clavate fusoid or narrowly fusoid, straight or curved.

On old capsules and stalks of *Oenothera biennis* L., *Baptisia tinctoria* (L.) R. Br., North America.

Material examined:

New York: Cold Spring Harbor, July 1893, *Johnson* (MICH). New Jersey: *Ell. & Ev. N.A.F. 1681* (*S. oenotherae*), *N.A.F. 1798* (*S. granulata*). Kansas: *Ell. & Ev. N.A.F. 2135* (*S. granulata*).

A second species of *Mycosphaerella* occurs on *Oenothera* capsules in addition to *M. oenotherae.* It is a small species near *M. minor* in subgenus *Didymellina.*

Mycosphaerella punctata Dearn. & House, Circ. New York State Mus. 24: 33. 1940 (without Latin diagnosis).

Ascocarpia 122–138 μ diametro, globoso-conica. Asci 45–72 × 15 μ, bitunicati. Ascosporae 30–36 × 6 μ, fusoideae, hyalinae, inequilaterales vel curvulatae.

In caulibus emortuis *Thalictri polygami,* prope "Newcomb, New York, 11 July 1925," legit *H. D. House*; in herb. New York State Museum depositum.

Ascocarps 122–138 μ diam, globose conic, thickly scattered; wall thin. Asci 45–72 × 15 μ. Ascospores 30–36 × 6 μ, narrowly fusoid, inequilateral or slightly curved.

On overwintered stalks of *Thalictrum polygamum* Muhl., eastern North America.

Material examined:

New York: Newcomb, 11 July 1925, *House* (type, NYS).

Sect. **Longispora** Barr, sect. nov.

In foliis et caulibus emortuis; ascosporae elongato-fusoideae, extremitatibus acutis.

Species typicum: *M. linnaeae* Barr.

Saprobic; ascospores fusoid-elongate, with length:width ratio 6:1 or more.

1. Series of *M. linnaeae:* Ascospores medium-sixed, 16–24 × (1.5–)2–3.5 μ.

Mycosphaerella linnaeae Barr in Bigelow & Barr, Rhodora 68: 187. 1966. Figures 103–104.

This species was described recently (Bigelow & Barr, 1966) from overwintered leaves of *Linnaea borealis* L. var. *americana* (Forbes) Rehd.

Mycosphaerella infuscans (Ell. & Ev.) Barr, comb. nov.

≡ *Sphaerella infuscans* Ell. & Ev. Bull. Torrey Bot. Club 25: 504. 1898.

Ascocarps 64–112 μ diam, globose, thickly scattered, with connecting hyphae forming blackened areas; wall thin. Asci 48–64 × 6.5–8 μ. Ascospores 17.5–21 × 3–3.5 μ, hyaline, fusoid, straight or curved.

On overwintered petioles of *Liriodendron tulipifera* L., North America.

Material examined:

West Virginia: *Ell. & Ev. Fungi Columbiani 1330.*

Mycosphaerella vaccinii (Cooke) Schroet. in Cohn, Kryptogamenfl. Schlesien 3(2): 335. 1894.

≡ *Sphaerella vaccinii* Cooke, J. Bot. 4: 249. 1866.
≡ *Carlia vaccinii* (Cooke) v.Höhnel, Hedwigia 62: 39. 1921.

Ascocarps 56–115 μ diam, globose to conic, hypophyllous, grouped to form dark blotches, with brown connecting hyphae, at times closely grouped and forming stromatic complexes; wall thin. Asci 27–51 × 6–8(–11) μ. Ascospores 16–22.5 × (1.5–)2–3 μ, fusoid, straight or slightly curved.

On overwintered leaves of *Vaccinium* spp., *Andromeda glaucophylla* Link, Europe, North America.

Material examined:

Europe: *Sydow, Mycotheca germ. 1549, 2335; Krieger Fungi Sax. 373.* Northwest Territories: Head of Clyde Inlet, Baffin Island, 24 June and 7 July 1950, *Dansereau* (DAOM, MASS). Newfoundland: Red Bay, 23 June 1954, *Wilce* (DAOM, MASS). Quebec: *Barr 1982* (DAOM, MASS).

2. Series of *M. grossulariae:* Ascospores large, 25–40 × 3–4(–5) μ.

Mycosphaerella grossulariae (Auersw.) Lindau in Engler & Prantl, Natürl. Pflanzenfam. 1(1): 424. 1897.

≡ *Sphaerella grossulariae* Auersw. in Gonnerm. & Rabenh. Mycol. Europ. 5/6: 11. 1869.

Ascocarps 112–144 μ diam, depressed globose, hypophyllous, scattered or loosely grouped; wall thin. Asci 48–72 × 9.5–13(–16) μ. Ascospores 29–40 × 3–4(–5) μ, hyaline, fusoid elongate, straight to curved, in two fascicles in the ascus.

Conidial state: *Septoria ribis* Desm.: Pycnidia globose, hypophyllous or amphigenous; conidia 40–50 × 1–2 μ, filiform, hyaline, 2–3-septate.

Conidial state forming leaf spots; ascal state in overwintered leaves of species of *Ribes,* Europe, North America.

Material examined:

Europe: *Krieger, Fungi sax. 1468; Sydow, Mycotheca germ. 581, 2929.* Ontario: *Fungi Columbiani 4943.*

Sphaeria grossulariae Fries has been considered by some to be this species, but Fuckel (1970), Klebahn (1918), Shear (1943), and Wehmeyer (1961) all agreed that Fries' fungus was a *Pleospora,* considered to be a synonym of *P. herbarum.* The name and authorities cited above are based on Shear's (1943) studies. Stone (1916) and Klebahn (1918) worked out the connection of the *Septoria* with the perfect state; others had earlier noted their association.

Mycosphaerella dolichospora (Sacc. & Fautr.) Wehm. Mycologia 38: 162. 1946.

≡ *Sphaerella dolichospora* Sacc. & Fautr. Rev. Mycol. (Toulouse) 19: 143. 1897.

Ascocarps 128–160 μ diam, depressed globose, grouped and forming blackened areas on stalks, connected by brown hyphae; wall relatively thick. Asci 48–60 ×

14.5–16 μ. Ascospores 25.5–40 × 3(–4) μ, hyaline, fusoid elongate, straight to curved, in two overlapping fascicles in the ascus.

On herbaceous stalks, usually of umbellifers, Europe, North America.

Material examined:

Washington: *Simmons 1405, 1489c* (MICH).

Mycosphaerella alnicola (Peck) Jaap, Ann. Mycol. 15: 105. 1917. Figure 105.

≡ *Sphaerella alnicola* Peck, Annual Rep. New York State Mus. 40: 68. 1887.

Ascocarps 75–120 μ diam, depressed globose, hypophyllous, scattered to grouped; apices erumpent as shining black dots; wall relatively thick. Asci 45–54 × 11–12.5 μ. Ascospores 27–34 × 4–4.5 μ, hyaline, narrowly obovate elongate, straight to slightly curved, in two overlapping fascicles in the ascus.

On overwintered leaves of *Alnus crispa* (Ait.) Pursh, North America, Europe.

Material examined:

New York: Mt. Marcy, June 1886, *Peck* (type, NYS); Lower Ausable, June, *Peck* (NYS).

Jaap (1917) reported this species from Switzerland and transferred the species to *Mycosphaerella* prior to House's combination in Bull. New York State Mus. 233–234: 25. 1920.

Sect. **Plaga** Barr, sect. nov.

In foliis vivis; ascosporae fusoideae, extremitatibus acutis.

Species typicum: *M. colorata* (Peck) House.

Parasitic, the ascocarps developing and maturing in leaf spots in living leaves; spots usually limited by a marginal zone; ascospores fusoid, the ends pointed.

1. Series of *M. prenanthis:* Ascospores 10–12.5 × 2–3.5 μ.

Mycosphaerella prenanthis (Ell. & Ev.) Barr, comb. nov.

≡ *Laestadia prenanthis* Ell. & Ev. J. Mycol. 8: 66. 1902.

Leaf spots light brown, the margin slightly raised; ascocarps 50–80 μ diam, globose or conic or depressed, mostly hypophyllous, scattered; wall thin. Asci 23–27.5 × 8–11 μ. Ascospores 10–12 × 2.5–3.5 μ, hyaline, narrowly obovate fusoid, straight or slightly curved.

On living leaves of *Prenanthes crepidinea* Michx., North America.

Material examined:

Alabama: Tuskegee, Aug 1901, *Carver 925* (type, NY).

Mycosphaerella exutans (Cooke) Barr, comb. nov.

≡ *Sphaerella exutans* Cooke, J. Linn. Soc. Bot. 17: 144. 1880.

Leaf spots 0.5–3 mm wide, blackish with grayish margin and brown beyond the margin into the leaf, or pallid in the center with a black ring, epiphyllous; ascocarps 78–110 μ diam, 90–130 μ high, globose or ovate, mostly epiphyllous, immersed, erumpent and raising flaps of epidermal cells; wall 10–12 μ thick. Asci 35–40 × 9–10 μ. Ascospores 11–13 × 2.5–3 μ, hyaline, narrowly obovate above, tapering to a fusoid base, straight to inequilateral.

On living leaves of *Persea borbonia* (L.) Spreng., North America.

Material examined:

Texas: Galveston Bay, Harris Co., Mar 1869, *Ravenel 46* (isotype, NY).

Cooke described the ascospores as "inaequaliter uniseptatis, hyalinis (.022 × .004 mm.)," quite different from my findings. The ascocarps are described precisely as I found them to be, however, so I must conclude that some error was made in Cooke's

observations on the ascospores. Ascospores of *Pseudomassaria perseae* Hodges and Barr (1971) could have been those of Cooke's brief description. However, no perithecia of the latter fungus were found on the isotype specimen of *S. exutans.*

Mycosphaerella operculata (Sacc.) Barr, comb. nov.

≡ *Sphaerella operculata* Sacc. Nuovo Giorn. Bot. Ital. II. 27: 76. 1920.

Leaf spots dull brown, angular, not distinctly margined; ascocarps uni- or multiloculate, epi- or hypophyllous, 110–140 μ diam or up to 220–275 μ, 110–165 μ high, immersed, erumpent and raising a flap of cuticle and epidermal cells; wall 15 μ thick, with brown hyphae into the leaf tissues. Asci 35–45 × 8–9 μ; locule cells remaining above. Ascospores 10–12.5 × 2.5–3 μ, hyaline, narrowly obovate fusoid, inequilateral or slightly curved.

Microconidial locules present in immature ascocarps.

On living leaves of *Quercus chrysolepis* Liebm., western North America.

Material examined:

California: Cedar Camp Road, California National Forest, 23 June 1928 (Forest Disease Herbarium Berkeley).

This species appears to be a small-spored form closely related to *M. janus.* However, in that fungus the leaf spots are brownish, grayish or whitish and have a reddish brown margin. Sydow and Petrak (1924) suggested that the locule tissue with mature asci warranted transferring *S. operculata* to *Didymella,* but the tissue is not pseudoparaphysate.

2. Series of *M. colorata:* Ascospores (10.5–)12–19 × 1.5–3.5 μ.

Mycosphaerella colorata (Peck) House, Bull. New York State Mus. 233–234: 26. 1921.

≡ *Sphaerella colorata* Peck, Annual Rep. New York State Mus. 29: 62. 1878.

Leaf spots 1–2(–8) mm diam, brown becoming grayish with purplish brown margin on the upper surface, brown and the margin less distinct on the lower surface; ascocarps 75–112 μ diam, globose, scattered or grouped, mostly epiphyllous; wall thin; cells of the apical wall and overlying epidermis vinaceous in water. Asci 32–60 × 6–9.5(–11) μ. Ascospores 12.5–16(–17.5) × 1.5–3 μ, hyaline, fusoid, straight or curved.

On living leaves of *Kalmia angustifolia* L., *K. latifolia* L., North America.

Material examined:

Newfoundland: *Fungi Columbiani 1328.* Nova Scotia: *Fungi Columbiana 3085.* New York: Center (Karner), June, *Peck* (type, NYS). Numerous collections from northeastern North America have been examined.

Mycosphaerella coptis (Schw.) House, Bull. New York State Mus. 233–234: 27. 1921. Figures 90-92.

≡ *Sphaeria coptis* Schw. Trans. Amer. Philos. Soc. II. 4: 224. 1832.
≡ *Sphaerella coptis* (Schw.) Farlow, Appalachia 3: 247. 1884.
≡ *Laestadia coptis* (Schw.) Ell. & Ev. North Amer. Pyrenomyc. 261. 1892.

Leaf spots up to 1 cm diam, gray to grayish white, the margin reddish brown, surrounded by an indefinite brown zone; ascocarps 50–90 μ diam, globose, hypophyllous; wall thin. Asci 29–43 × 7.5–9 μ. Ascospores 10.5–15 × 1.5–3 μ, hyaline, fusoid, straight or slightly curved.

Conidial state: *Septoria coptidis* Berk. & Curt.: Pycnidia 90–165 μ diam, globose or ovoid, epiphyllous in leaf spots; conidia 52–60 × 1.5 μ, hyaline, filiform, curved.

On living leaves of *Coptis groenlandica* (Oeder) Fern., eastern North America.

Material examined:

Quebec: *Barr 1929A, 1975* (DAOM, MASS). Massachusetts: *Ell. & Ev. N.A.F. 2358, 2359.*

Mycosphaerella fragariae (Tul.) Lindau in Engler & Prantl, Natürl. Pflanzenfam. 1(1): 424. 1897.

≡ *Sphaeria fragariae* Tul. Ann. Sci. Nat. Bot. IV. 5: 112. 1856.
≡ *Stigmatea fragariae* (Tul.) Tul. Select. Fungorum Carp. 2: 286. 1863.
≡ *Sphaerella fragariae* (Tul.) Sacc. Michelia 1: 536. 1879.

Leaf spots 1–3 mm diam, grayish brown or whitish, the margin brown or purplish brown; ascocarps 128–160 μ diam, globose or conic, mostly epiphyllous, scattered or grouped; wall thin. Asci 50–70 × 9.5–13 μ. Ascospores 11–14.5 × 3 μ, hyaline, fusoid, straight.

Conidial state: *Ramularia brunnea* Peck: Conidiophores arising in fascicles from subepidermal hyphae or from apex of sterile ascocarps, hyaline; primary conidia sympodiospores, secondary conidia blastospores, forming a chain, hyaline, 14–45 × 2–3 μ, 1 (–3)-septate.

On *Fragaria* spp., cosmopolitan.

Material examined:

Europe: *Krieger Fungi sax. 1359.* North America: Massachusetts: Waltham, 9 Oct 1909, Seymour (MICH). Michigan: Ann Arbor, 27 May 1922, *Kanouse* (MICH). Pennsylvania: *Ellis N.A.F. 1239.* Wisconsin: *Fungi Columbiani 3983.* Wyoming: *Fungi Columbiani 3780.* Washington: *Fungi Columbiani 4486.* Texas: College Station, 23 Feb 1890, *Jennings* (MICH).

This species is usually collected as the conidial state, as in the North American collections cited above.

Mycosphaerella pardalota (Cooke & Ellis) Barr, comb. nov.

≡ *Sphaerella pardalota* Cooke & Ellis, Grevillea 6:16. 1877.

Leaf spots brownish, not margined; ascocarps 80–96 μ diam, globose, amphigenous, thickly grouped; wall thin. Asci 35–48 × 6.5–8 μ. Ascospores 11–17.5 × 3–3.5 μ hyaline, fusoid, straight or slightly curved.

In leaves of *Myrica cerifera* L., eastern North America.

Material examined:

New Jersey: *Ell. & Ev. N.A.F. 2136.*

3. Series of *M. janus:* Ascospores large, (14–)16.5–26.5 × 3–6 μ.

Mycosphaerella janus (Berk. & Curt.) Petrak, Sydowia 11: 340. 1958 ["1957"]. Figure 93.

≡ *Sphaeria janus* Berk. & Curt. Grevillea 4: 154. 1876.
≡ *Leptosphaeria janus* (Berk. & Curt.) Sacc. Syll. Fungorum 2: 85. 1883.
≡ *Metasphaeria janus* (Berk. & Curt.) Berlese, Icon. Fungorum 1: 88. 1894.
≡ *Dothidella janus* (Berk. & Curt.) v.Höhnel, Sitzungsber. Kaiserl. Akad. Wiss. Math.-Naturwiss. Kl. Abt. I, 124: 67. 1915.
= *Sphaerella weiriana* Sacc. Nuovo Giorn. Bot. Ital. II. 12: 76. 1920.
= *Dothidella castanopsidis* Dearn. Mycologia 16: 155. 1924.
≡ *Mycosphaerella castanopsidis* (Dearn.) Petrak, Ann. Mycol. 39: 311. 1941.
= *Dothidella castanicola* Bonar, Mycologia 20: 294. 1928 [as *D. castanicola* (Ell. & Ev.) Bonar].

Leaf spots brown; margin dark reddish brown, raised; ascocarps uni- or occasionally multiloculate, 150–170 μ diam or larger, globose, epiphyllous, scattered singly or in small groups, widely erumpent; wall relatively thick above, with stromatic complexes of hyphae in leaf tissues connecting adjacent ascocarps. Asci 54–72 × 10.5–12 μ.

Ascospores 18–22.5 × 4.6–6 μ, hyaline, elliptic fusoid, tapering more sharply to base than to apex, straight, curved, or bent.

Conidial state: *Asteromella castanicola* (Ell. & Ev.) Petrak: Pycnidia similar to ascocarps; conidia 3–3.5 × 1–1.5 μ, hyaline. Bonar (1928) reported on parallel cultures of single conidia and ascospores: pycnidia were formed in both series of cultures but ascocarps were never formed, despite the utilization of a wide variety of media.

On leaves of *Castanopsis* and *Quercus* spp., southern and western North America.

Material examined (pro parte):

Oregon: Star, Lane Co., 22 June 1921, *Boyce 840* (type of *D. castanopsidis*, BPI). California: *Mycobiota of North America 28, 28-A; Calif. Fungi 448, 261, 410, 1023.* Numerous other collections of this fungus exist in herbaria. It has been recorded from Washington, Oregon, California, Nevada, New Mexico, Texas, and Florida (W. B. Cooke 1952).

Petrak (1941, 1958a) discussed the position of the species and brought together much information on its synonymy. Cooke (1952) contributed to details of distribution on various species of *Castanopsis* and *Quercus* as well as to synonymy.

Mycosphaerella glauca (Cooke) Barr, comb. nov.

≡ *Sphaerella glauca* Cooke, Hedwigia 17: 39. 1878.

Leaf spots on upper leaf surface angular, 3–10 mm wide, grayish, the margin dark reddish brown, becoming dull dark brown and blotchy; spots scarcely visible on the lower surface; ascocarps 100–160 μ diam, globose, hypophyllous, at times epiphyllous, scattered to grouped but not united; wall 10–16.5 μ thick; hyphae brown in leaf tissues. Asci 44–80 × 9–14.5 μ. Ascospores 16.5–26.5 × 3–4.5 μ, hyaline, narrowly obovate-fusoid, straight or slightly curved.

On *Magnolia virginiana* L. (syn. *M. glauca*), eastern North America.

Material examined:

New Jersey: *Ellis N.A.F. 800* (as *S. magnoliae* Ellis, n.s.). Florida: *Ellis N.A.F. 1350.*

Cooke described the ascospores of *S. glauca* as "breviter lanceolatis, ...012–.014 × .004 mm," a contradiction of term and sizes. In other respects his brief description fits these collections. It seems reasonable that ".012–.014" was a typographical error for ".022–.024," which would satisfy the term "lanceolate" as well as fall within the size range noted in the collections cited. Tracy and Earle (1896) reported a collection of *S. glauca* with ascospores similar in size to those in my description.

Sphaerella magnoliae Ellis (Bull. Torrey Bot. Club 9: 74. 1881) was described as having ascospores clavate oblong, 7 × 2.5 μ. Ellis' N.A.F. 800 bears in addition to the fungus which I term *M. glauca* a species of *Glomerella* with small ascospores one-celled 9–11 × 2–3.5 μ. This fungus, with collapsing perithecia, is visible under the dissecting microscope as a black ring of wall tissue surrounding a whitish center. It would appear to be identical to *Sphaeria magnoliae* Schw. (Trans. Amer. Philos. Soc. II, 4: 226. 1832), described as ". . . demum collapsis, nigris, sed disco albescente." Schweinitz's specimen is not in his herbarium (Ellis and Everhart 1892). Ellis originally stated that *Sphaerella magnoliae* Ellis was distinct from *Sphaeria magnoliae* Schw., but Ellis and Everhart (1892) combined the two taxa under the name *Laestadia magnoliae* (Schw.) Sacc. Probably the names *Phyllachorella magnoliae* (Schw.) v.Höhnel and *Guignardia magnoliae* (Schw.) Miller also refer to the *Glomerella.*

Mycosphaerella acervata (Ell. & Ev.) Barr, comb. nov. Figures 98-99.

≡ *Diatrype acervata* Ell. & Ev. J. Mycol. 4: 75. 1888.
≡ *Diaporthe acervata* (Ell. & Ev.) Ell. & Ev. North Amer. Pyrenomyc. 738. 1892.

Ascocarps multiloculate, 300–440 μ diam, 165–300 μ high, with brown hyphae around base and sides and into epidermal cells, a few in elliptic gray brown leaf spots,

reddish brown margined, or scattered in older leaves; locules 70–123 μ diam. Asci 28.5–50 × 8–11 μ. Ascospores 14–22 × 3–5 μ, hyaline, elliptic fusoid, inequilateral to slightly curved.

On leaves of *Yucca* spp., North America.

Material examined:

New Jersey: *Ell. & Ev. N.A.F. 2124.* North Dakota: *Brenckle's Fungi Dakot. 438* (as *Kellermannia yuccaegena,* NY). California: Soledad Canyon, 19 May 1935, *Plunket* (as *Plowrightia circumscissa,* NY).

Wehmeyer (1933) noted that this species was a dothideaceous fungus. Ellis and Everhart (1892) observed "sporidia . . . exactly resembling the sporidia of a *Sphaerella.*"

Subgenus **Didymellina** (v.Höhnel) Barr, stat. nov.

≡ *Didymellina* v.Höhnel, Ann. Mycol. 16: 66. 1918.
≡ *Mycosphaerella* sect. *Didymellina* (v.Höhnel) v.Arx, Sydowia 3: 38. 1949.

Asci saccate, ovoid, or broadly oblong, relatively few in a fascicle, arising from a somewhat arched basal cushion of hyaline cells; ascospores mostly crowded in the ascus. Macroconidial state variable; conidia blastospores.

Section **Didymellina**

Parasitic, often forming spots in leaves.

Type species: *M. iridis* (Desm.) Schroet.

1. Series of *M. polifoliae:* Ascospores small, 10–14(–15) × 2–4.5 μ.

Mycosphaerella polifoliae (Ell. & Ev.) Bubák, Ann. Mycol. 4: 109. 1906. Figures 108–109.

≡ *Sphaerella polifoliae* Ell. & Ev. Proc. Acad. Nat. Sci. Philadelphia 42: 231. 1891 ["1890"].

Leaf spots irregular, extending from tip of leaf inward, grayish brown; ascocarps 60–100 μ diam, globose or conic, epiphyllous; wall thin. Asci 28.5–38.5 × 7.5–10 μ. Ascospores 10–13 × 3–3.5 μ, hyaline, obovate, straight.

On leaves of *Andromeda glaucophylla* Link, North America, Europe.

Material examined:

Ontario: London, Aug 1889 and Sept 1889, *Dearness* (type, NY). New York: Blue Mountain, 23 Aug 1934, *Shear* (as *Venturia gaultheriae,* BPI).

Mycosphaerella sarraceniae (Schw. ex Fr.) P. Henn. Verh. Bot. Vereins Prov. Brandenburg 40: 157. 1898.

≡ *Sphaeria sarraceniae* Schw. ex Fr. Syst. Mycol. 2: 516. 1823.
≡ *Sphaerella sarraceniae* (Schw. ex Fr.) Peck, Annual Rep. New York State Mus. 29: 70. 1878; Sacc. Syll. Fungorum 1: 502. 1882.

Leaf spots large, extending from the tip through much of the leaf, brown at first, soon gray, purplish margined; ascocarps (32–)60–90 μ diam, globose, amphigenous; wall brown, with ample brown hyphae in leaf tissues. Asci (16–)24–35 × (8–)11–14.5 μ. Ascospores (9.5–)11–15 × 3–4.5 μ, hyaline, obovate, straight.

On leaves of *Sarracenia purpurea* L., North America.

Material examined:

Quebec: *Barr 2082* (MASS). Manitoba: "Port Arthur" Winnipeg, 1891, *Dewart* (MICH). Michigan: Ann Arbor, 22 June 1894, *Johnson,* 25 May 1922, *Wehmeyer* (MICH).

A second species of *Mycosphaerella* occurs at times in the leaf spots. It belongs in subgenus *Mycosphaerella,* with scattered ascocarps, oblong asci 32–45 × 6.5–8 μ, and

biseriate, fusoid ascospores 8.5–11 × 2–3 μ. This is the species that Ellis and Everhart (1892) described as *Sphaerella sarraceniae.*

Mycosphaerella thalictri (Ell. & Ev.) Lindau in Engler & Prantl, Natürl. Pflanzenfam. 1(1): 424. 1897.

≡ *Sphaerella thalictri* Ell. & Ev. J. Mycol. 1: 44. 1885.
= *Sphaerella septorioides* Peck, Annual Rep. New York State Mus. 32: 52. 1879, *non S. septorioides* (Desm.) Niessl 1877.
≡ *Sphaerella thalictricola* Sacc. & Syd. Syll. Fungorum 14: 534. 1899.

Leaf spots small, 0.5–4 mm wide, white, the margin reddish brown or brown; ascocarps 64–100 μ diam, globose or depressed, scattered to grouped, hypophyllous but visible through thin tissues on upper surface; wall thin. Asci 27–42 × 8–13 μ. Ascospores 11–14 × 3–4.5 μ, hyaline, obovate with tapered ends, straight or inequilateral.

On leaves of *Thalictrum dioicum* L., *T. polygamum* Muhl., *T. dasycarpum* Fisch. & Lall., North America.

Material examined:

New York: Central Bridge, June 1878, *Peck* (type of *S. septorioides,* NYS); *Bartholomew, Fungi Columbiani 4080.* Wisconsin: *Greene 81, 222* (MICH).

Mycosphaerella ilicis (Ell.) Lindau in Engler & Prantl, Natürl. Pflanzenfam. 1(1): 425. 1897.

≡ *Sphaerella ilicis* Ell. Amer. Naturalist 17: 317. 1883.

Leaf spots 2–5 mm wide or larger by confluence, grayish brown with raised dark brown margin on upper surface, brown below; ascocarps 56–80 μ diam, amphigenous, scattered; wall thin. Asci 19–35 × 9.5–11 μ. Ascospores 11–14 × 2–3.5 μ, hyaline, obovate, straight to inequilateral.

On leaves of *Ilex glabra* (L.) Gray, North America.

Material examined:

New Jersey: *Ellis N.A.F. 1351.*

2. Series of *M. gaultheriae:* Ascospores medium-sized, (9–)13–20 × 3–4.5(–5) μ.

Mycosphaerella gaultheriae (Cooke & Ellis) House, Bull. New York State Mus. 233–234: 27. 1921.

≡ *Sphaerella gaultheriae* Cooke & Ellis, Grevillea 7: 42. 1878. (as *S. gaultheriae* "C. & P." but article by Cooke and Ellis).

Leaf spots 2–10 mm wide, grayish brown with raised purplish margin on upper surface, brown below; ascocarps 72–112 μ diam, globose, mostly epiphyllous, thickly grouped or often forming concentric rings in the spot; wall thin. Asci 35–48 × 8–11(–14.5) μ. Ascospores 9–17.5 × 3–4 μ, hyaline, narrowly obovate, straight.

On leaves of *Gaultheria procumbens* L., *G. shallon* Pursh, North America.

Material examined:

British Columbia: *Barr 1584* (MASS). Massachusetts: *Barr 2447, 3292A* (MASS). New Jersey: *Ellis N.A.F. 799.* California: Noyo, Mendocino Co., 11 July 1937, *Bonar* (MICH).

Mycosphaerella heucherae (Ell. & Ev.) Petrak, Sydowia 11: 240. 1958 ["1957"].

≡ *Dothidella heucherae* Ell. & Ev. Bull. Torrey Bot. Club 27: 571. 1900.

Leaf spots 4–6 mm wide or larger by confluence, dark brown, finally grayish brown, the margin indistinct or darker brown than the spots; ascocarps 50–100 μ diam, globose or conic, amphigenous, thickly scattered to grouped and connected by

brown hyphae; wall thin. Asci 40–45 × 9–11 μ. Ascospores 15.5–18 × 3.5–4.5 μ, hyaline, obovate with tapered ends, straight to inequilateral.

Microconidial state: *Phyllosticta heucherae* Ell. & Ev.: Pycnidia amphigenous in leaf, 80–100 μ diam; conidia 4–6 × 1–1.5 μ, hyaline, oblong, one-celled.

On leaves of *Heuchera cylindrica* Dougl. var. *glabella* (T. & G.) Wheel., western North America.

Material examined:

Idaho: *Idaho Plants 3265* (NY). Washington: Waitsburg, 27 Mar 1900, *Horner* (type, BPI, NY); Spokane, 16 Mar 1921, *Weir* (BPI).

Mycosphaerella cypripedii (Peck) House, Bull. New York State Mus. 233–234: 27. 1921.

≡ *Sphaerella cypripedii* Peck, Annual Rep. New York State Mus. 51: 296. 1899.

Leaf spots brown, marginate; ascocarps 65–115 μ diam, conic, amphigenous, thickly scattered; wall relatively thick, with brown hyphae in leaf tissues. Asci 37–45 × 11–13.5 μ. Ascospores 13.5–17 × 3–4.5 μ, hyaline, obovate, tapered to base, straight.

On leaves of *Cypripedium* sp., eastern North America.

Material examined:

New York: Bay Ridge, Long Island, Oct 1896, *Stewart* (type, NYS).

Mycosphaerella pontederiae (Peck) House, Bull. New York State Mus. 233–234: 29. 1921.

≡ *Sphaerella pontederiae* Peck, Annual Rep. New York State Mus. 40: 69. 1887.
= *Sphaerella paludosa* Ell. & Ev. North Amer. Pyrenomyc. 294. 1892.

Leaf spots 6–10 mm diam, or elongate or confluent and covering much of the leaf, irregular, dark brown, grayish brown below; ascocarps 48–90 μ diam, globose or conic, either hypo- or epiphyllous, with ample brown hyphae connecting and penetrating deep into leaf tissues; wall thin. Asci 31–45 × 13.5–21 μ. Ascospores 13.5–20 × 3–5 μ, hyaline, obovate, straight or inequilateral.

On leaves of *Pontederia cordata* L., *Nuphar* and *Nymphaea* spp., eastern North America.

Material examined:

Ontario: *Ell. & Ev. N.A.F. 2357* (as *S. paludosa*). New York: Whitehall, Sept, *Peck* (type of *S. pontederiae*, NYS). Michigan: Ann Arbor, 18 Sept 1894, *Johnson* (MICH).

3. Series of *M. iridis:* Ascospores large, (12–)15–24 × (3.5–)5–8 μ.

Mycosphaerella iridis (Desm.) Schroet. in Cohn, Kryptogamenfl. Schlesien 3(2): 339. 1894. Figure 106–107.

≡ *Dothidea iridis* Desm. Ann. Sci. Nat. Bot. III, 8: 176. 1847.
≡ *Sphaerella iridis* (Desm.) Auersw. in Gonnerm. & Rabenh. Mycol. Europ. 5/6: 18. 1869.
≡ *Metasphaeria iridis* (Desm.) Sacc. Syll. Fungorum 2: 178. 1883.
≡ *Didymellina iridis* (Desm.) v.Höhnel, Ann. Mycol. 16: 66. 1918.
= *Sacidium desmazierii* Mont. in Desm. Plant. Crypt. France, n. 351. 1856.
≡ *Sphaerella desmazierii* (Mont.) Sacc. Syll. Fungorum 11: 301. 1895.
= *Sphaerella pseudacori* Kirschst. Kryptogamenfl. Mark Brandenburg 7: 402. 1938.

Leaf spots irregular, grayish brown, the margin brown; ascocarps 40–80 μ diam, globose, amphigenous, scattered or grouped; wall thin. Asci 27.5–51 × (12–)16–27 μ. Ascospores 12–22.5 × (3.5–)5–6.5 μ, hyaline, obovate, tapered to base, straight or inequilateral.

Conidial state: *Cladosporium (Heterosporium) gracile* Wallr.: Conidiophores fasciculate, brown, elongating, the scars usually lateral; conidia 25–60 × 12–20 μ,

brown, one-celled at first, soon 1–3–4-septate, oblong or irregular, the wall thick, coarsely echinulate.

On leaves and flowering parts of *Iris* spp., widespread.

Material examined:

Europe: *Krieger, Fungi sax. 2064; Rehm, Ascom. 1763; Sydow, Mycotheca germ. 677, 786, 2329.* North America: Northwest Territories: *Bartlett 3816* (MICH). Newfoundland: Blanc Sablon, 19 July 1957, *Wilce* (MASS). Michigan: Rock River, 22 Aug 1927, *Kanouse* (MICH).

Mycosphaerella allicina (Fr.) Vestergren, Bih. Kongl. Svenska Vetensk.-Akad. Handl. 22, Afd. III, 6: 15. 1896.

≡ *Sphaeria allicina* Fr. Syst. Mycol. 2: 437. 1823.
≡ *Sphaerella allicina* (Fr.) Auersw. in Gonnerm. & Rabenh. Mycol. Europ. 5/6: 19. 1869.

Leaf spots brown, often extending from the tip of the leaf downward; ascocarps 80–104 μ diam, globose or conic; wall relatively thin. Asci 41.5–70 × 16–24 μ. Ascospores 15–24 × 5–8 μ, hyaline, obovate, straight.

On leaves of *Allium* spp., Europe, North America.

Material examined:

Europe: *Briosi & Cavara 307.* North America: Wisconsin: Middleton, Dane Co., 7 July 1944, *Greene* (MICH).

Although *M. allicina* is similar morphologically to *M. tassiana,* and was included as a synonym of that species by von Arx (1949), it must be considered distinct because of its parasitic nature. A number of other names are probably synonymous with *M. allicina.*

Sect. **Cymadothea** (Wolf) v.Arx, Sydowia 3: 37. 1949.

≡ *Cymadothea* Wolf, Mycologia 27: 71. 1935.

Ascocarps usually multiloculate, maturing in overwintered leaves; ascospores obovate; conidial state *Polythrincium,* parasitic and causing conspicuous leaf blotches.

Type species: *M. killianii* Petrak.

Mycosphaerella killianii Petrak, Ann. Mycol. 39: 324. 1941. Figures 110–112.

≡ *Sphaeria trifolii* Pers. ex Fr. Syst. Mycol. 2: 435. 1823, not *M. trifolii* (Karst.) Moesz (1926).
≡ *Dothidea trifolii* (Pers. ex Fr.) Fr. Summa Veget. Scand. 387. 1849.
≡ *Phyllachora trifolii* (Pers. ex Fr.) Fuckel, Symb. Mycol. 218. 1870.
≡ *Plowrightia trifolii* (Pers. ex Fr.) Killian, Rev. Pathol. Vég. Entomol. Agric. France 10: 219. 1923.
≡ *Dothidella trifolii* (Pers. ex Fr.) Bayliss-Elliott & Stansfield, Trans. Brit. Mycol. Soc. 9: 226–7. 1924.
≡ *Cymadothea trifolii* (Pers. ex Fr.) Wolf, Mycologia 27: 71. 1935.

Ascocarps uni- or multiloculate, erumpent, the apex conic; locules ca. 130 μ diam; wall relatively thick. Asci 50–55 × 20–30 μ. Ascospores 22–25 × 6–7.5 μ, hyaline, obovate, straight or inequilateral.

Conidial state: *Polythrincium trifolii* Schmidt & Kunze ex Fr.: Conidiophores arising from a brown stromatic base, erumpent through the lower leaf surface, in fascicles and thickly grouped to form small sooty spots; conidiophores wavy in outline, elongating sympodially, dark brown, 40–50 μ long; conidia 14–17 × 10–12 μ, brown, ovate, truncate at base, one-septate, the wall finely roughened. Microconidial state: *Placosphaeria trifolii* (Pers. ex Fr.) Trav.: Microconidia minute, hyaline, one-celled.

On leaves of *Trifolium* spp., the conidial state and sterile stromata common on living leaves, the perfect state rare after overwintering, cosmopolitan.

Material examined (pro parte):

Switzerland: Kt. Graubünden, Davos, Dischmatal Jatzmäder, 29 May 1964, *Müller,* on *Trifolium alpinum* (BPI, mature ascocarps).

Numerous collections of the conidial state and immature ascocarps have been seen; this fungus is usually collected on living leaves as the *Polythrincium* state.

Much of the synonymy cited above is based on immature ascocarps. Wolf (1935) described development of the various states of the fungus, and erected the genus *Cymadothea* for the species. Petrak (1941) recognized that it was a species of *Mycosphaerella* and provided the necessary new name in transferring *Sphaeria trifolii* to this genus. He also noted that *Phyllachora umbilicata* Theiss. & Sydow, Ann. Mycol. 13: 510. 1915, synonymized with *C. trifolii* by Wolf, is a different fungus.

Sect. **Stigmina** Barr, sect. nov.

Status conidialis *Stigminae,* conidia annellosporae.

Species typicum: *M. stigmina-platani* Wolf.

Ascocarps uniloculate, maturing in overwintered leaves; ascospores obovate; conidial state *Stigmina,* parasitic, causing conspicuous leaf blotches.

Mycosphaerella stigmina-platani Wolf, Mycologia 30: 60. 1938.

Ascocarps 60–80(–96) μ diam, globose, hypophyllous, thickly scattered, often forming blackened areas; wall thin. Asci 25–45 × 8–16 μ. Ascospores 11–15.5 × 3.5–5 μ, hyaline, obovate, straight or inequilateral.

Conidial state: *Stigmina platani* (Fuckel) Sacc.: Conidiophores fasciculate, brown, erumpent through the stomata, elongating and annellate; conidia 15–40 × 7–10 μ, hyaline, soon dark olivaceous brown, oblong elliptic, 1–8-septate; wall thick, dark, coarsely roughened at times. Microconidial state: Pycnidia 55–65 μ diam, hypophyllous; conidia 2–3 × 1 μ, hyaline, oblong.

Conidial state parasitic, perfect state formed in overwintered leaves of *Platanus occidentalis* L., North America, Europe.

Material examined:

North Carolina: Durham, April 1937, *Wolf* (isotype, MICH). Texas: Houston, 8 April 1869, *Ravenel* (as *Sphaeria myriadea,* BPI). Examples of conidial state: *Fungi Columbiani 2885, 4293, 4988.*

The sizes which Wolf (1938) provided in his descriptions of asci and ascospores were larger, 55–70 × 9–11 μ and 17–19 × 6–7 μ respectively, than those I measured in the specimens cited.

Sect. **Tassiana** Barr, sect. nov.

In foliis et caulibus emortuis; ascosporae obovatae, extremitatibus rotundatis.

Species typicum: *M. tassiana* (de Not.) Johans.

Ascocarps saprobic; ascospores obovate.

1. Series of *M. minor:* Ascospores small, (6.5–)9–13(–15) × (2–)3–4.5(–5) μ.

Mycosphaerella minor (Karst.) Johans. Öfver. Förh. Kongl. Vetensk.-Akad. 1884 (9): 165. 1884. Figures 118–120.

≡ *Sphaerella minor* Karst. Mycol. Fenn. 2: 171. 1873.

Ascocarps 22–60(–75) μ diam, globose depressed, occasionally somewhat conic, immersed, in small groups seated on branching radiating brown hyphae; wall thin. Asci (14–)20–30(–37.5) × (8.5–)12–22.5 μ. Ascospores (6.5–)9–13(–15) × 2–4.5 μ, hyaline, obovate, straight.

On overwintered leaves and stalks of various herbs in subalpine and subarctic regions, Europe, North America.

Material examined: see Barr (1959) for numerous collections from Canadian eastern arctic regions.

M. minor is nearly as common as *M. tassiana* on various host plants, both monocots and dicots, in regions of higher latitude and altitude. The small depressed ascocarps grouped on radiating hyphae, and small ascospores, distinguish *M. minor* from *M. tassiana.*

Mycosphaerella borealis (Bubák & Vleugel) Barr, comb. nov.

≡ *Sphaerella (Mycosphaerella) borealis* Bubák & Vleugel, Svensk Bot. Tidskr. 11: 309. 1917.

Ascocarps 45–75 μ diam, globose of conic, immersed, hypophyllous, grouped and forming small grayish irregular spots, with brown hyphae in leaf tissues; wall thin. Asci 22–26.5 × 7.5–9 μ. Ascospores 9–10.5 × 3 μ, hyaline, obovate, straight or inequilateral.

On overwintered leaves of *Alnus* spp., Europe, North America.

Material examined:

New Hampshire: *Barr 3802* (with *Venturia alnea,* MASS). Vermont: *Barr 2986* (MASS).

Mycosphaerella recutita (Fr.) Johans. Öfver. Förh. Kongl. Vetensk.-Akad. 1884(9): 166. 1884.

≡ *Sphaeria recutita* Fr. Syst. Mycol. 2: 524. 1823.
≡ *Sphaerella recutita* (Fr.) Rabenh. in Klotz. Herb. Mycol. n. 659; Bot. Zeitung (Berlin) 16: 80. 1858.
≡ *Carlia recutita* (Fr.) v.Höhnel, Ber. Deutsch. Bot. Ges. 36: 314. 1918.

Ascocarps 37–82 μ diam, globose, immersed, grouped and forming long rows, parallel between leaf veins, or massed into acervulate groups, with brown hyphae connecting the ascocarps and penetrating deep into leaf tissues; wall thin. Asci 19.5–40 × 10–18 μ. Ascospores (8.5–)10–14 × 3–4.5 μ, hyaline, obovate, straight.

On overwintered leaves and stalks of monocotyledons in northern Europe, North America. Barr (1959) listed a number of collections from the Canadian eastern arctic.

Mycosphaerella lycopodii (Peck) House, Bull. New York State Mus. 233–234: 28. 1921.

≡ *Sphaerella lycopodii* Peck, Annual Rep. New York State Mus. 39: 51. 1886.

Ascocarps 30–90 μ diam, globose, immersed, thickly scattered, with brown connecting hyphae; wall thin. Asci 21–39 × 7–13 μ. Ascospores 8–13 × 2.5–3.5(–5) μ, hyaline, obovate, straight.

On overwintered sporophylls of *Lycopodium* spp., North America, Europe.

Material examined:

Northwest Territories: Frobisher Bay, Baffin Island, 1 June 1955, *Wilce* (DAOM, MASS). Quebec: Port Burwell, 17 Aug 1954, *Wilce* (DAOM, MASS). New York: Aden Lair, Essex Co., June, *Peck* (type, NYS). Michigan: *Povah Fp204, 468* (MICH).

2. Series of *M. typhae:* Ascospores medium-sized, (11–)13–16 × 3–5 μ.

Mycosphaerella typhae (Lasch) Lindau in Engler & Prantl, Natürl. Pflanzenfam. 1(1): 425. 1897.

≡ *Sphaeria typhae* Lasch in Klotzsch-Rabenh. Herb. Mycol. n. 660; Bot. Zeitung (Berlin) 3: 67. 1845.
≡ *Sphaerella typhae* (Lasch) Auersw. in Gonnerm. & Rabenh. Mycol. Europ. 5/6: 18. 1869.

Ascocarps (48–)64–80 μ diam, globose to conic, immersed, grouped and often connected at sides, forming long narrow dark streaks in leaf tissue, with brown hyphae connecting and surrounding the ascocarps; wall thin. Asci 28–40 × 10.5–16 μ.

Ascospores 12.5–16 × (3.5–)4–5 μ, hyaline becoming brown in age, obovate, straight or inequilateral.

On leaves of *Typha latifolia* L., Europe, North America.

Material examined:

Europe: *Rabenh.-Klotz. Herb. Mycol. n. 660* (isotype). North America: Michigan: *Barr 1533* (MASS). Pennsyvlania: *Ell. & Ev. N.A.F. 1678.*

Mycosphaerella groveana (Sacc.) v.Arx, the type species of *Scirrhiachora* Theiss. & Syd., occurs on the same host in England. It differs from *M. typhae* in having fusoid ascospores and in forming stromatic ascocarps which contain numerous locules. *M. groveana* would belong in sect. *Fusispora.*

Mycosphaerella chenopodii Dearn. & Barth. in Dearn. Mycologia 16: 157. 1924. Figures 115–117.

Ascocarps 80–130 μ diam, globose or depressed, thickly scattered, with brown connecting hyphae, blackening areas of the stalk; apex conic; wall thin. Asci 33–39 × 12–15 μ. Ascospores 13.5–16.5 × 3–4.5 μ, hyaline, obovate, straight or inequilateral.

On stalks of *Chenopodium leptophyllum* Nutt., North America.

Material examined:

Kansas: Stockton, 11 June 1923, *Bartholomew* (type), 24 July 1923, (both in *Dearness Herb.* in DAOM).

3. Series of *M. tassiana:* Ascospores large, (13–)16–29 × (3–)4.5–8(–9.5) μ.

Mycosphaerella tassiana (de Not.) Johans. Öfver. Förh. Kongl. Vetensk.-Akad. 1884(9): 167. 1884. Figures 113–114.

≡ *Sphaerella tassiana* de Not. Sfer. Ital. 87. 1863.

Ascocarps (64–)70–160 μ diam, conic or globose, immersed, erumpent, scattered to grouped. Asci 38.5–88 × 17–30 μ. Ascospores 16–29 × 4.5–8(–9.5) μ, hyaline, at times brownish and 2–3-septate in age, obovate, straight.

Conidial state: *Cladosporium herbarum:* See de Vries (1952) for description and illustration of this state.

On overwintered leaves and stalks of numerous hosts, both monocotyledons and dicotyledons, throughout subarctic and subalpine regions.

Barr (1959) provided numerous records from the Canadian Eastern Arctic and von Arx (1949) described European collections. This species is extremely common on overwintered plant stalks and leaves in high altitudes and latitudes. It appears to be omnivorous and has been described many times from different hosts. Von Arx (1949) detailed studies of a number of species which he synonymized with *M. tassiana,* and listed many host plants. Barr (1958) detailed the developmental history of this species, and (1959) recognized several varieties of it. The conidial state too has a number of synonyms as shown by de Vries' (1952) study.

Mycosphaerella coerulea (Ell. & Ev.) Tracy & Earle, Pl. Baker. 1: 33. 1901.

≡ *Sphaerella coerulea* Ell. & Ev. Proc. Acad. Nat. Sci. Philadelphia 46: 334. 1895.

Ascocarps 96–160 μ diam, depressed globose (the apex plane), immersed, adhering to the epidermis, shining black, thickly scattered; wall thin. Asci 36–48 × 11–16 μ. Ascospores (13–)16–20 × 4–5 μ, hyaline, narrowly obovate, straight, inequilateral, or slightly curved.

On stalks of *Aquilegia* sp., western North America.

Material examined:

Colorado: *Ell. & Ev. N.A.F. 3522;* above Milner Pass, Rocky Mt. Nat. Park, 22 Aug 1928, *Lohman* (MICH).

Mycosphaerella ludwigii Sydow, Ann. Mycol. 22: 260. 1924.

Ascocarps 60–100 μ diam, globose, shining black, grouped and connected by brown hyphae, forming darkened areas; wall thin. Asci 22–38.5 × 11–12 μ. Ascospores 13–21 × 3–4.5 μ, hyaline, narrowly obovate, straight or inequilateral.

On leaves and stalks of *Epilobium* spp., Europe, North America.

Material examined:

Northwest Territories: *Savile 2682A, 3828A* (DAOM).

Mycosphaerella ascophylli Cotton, Trans. Brit. Mycol. Soc. 3: 96. 1909.

≡ *Sphaerella ascophylli* (Cotton) Sacc. & Trotter, Syll. Fungorum 22: 147. 1913.

Ascocarps 72–160 μ diam, globose or conic, immersed; wall thin, light brown, the erumpent portion blackened. Asci 56–64 × 16–19 μ. Ascospores 14.5–22.5 × 5–6.5 μ, hyaline, elliptic obovate, straight.

In receptacles of *Ascophyllum nodosum* (L.) Le Jolis, Europe, North America.

Material examined:

Maine: Kittery Point, 24 May 1908, *Thaxter, Reliq. Farlowianae 82* (MICH).

Sect. **Fusispora** Barr, sect. nov.

In foliis et caulibus emortuis; ascosporae fusoideae, extremitatibus acutis.

Species typicum: *M. lineolata* (Rob. in Desm.) Schroet.

Ascocarps saprobic; ascospores fusoid, the ends pointed.

1. Series of *M. sphaerellula:* Ascospores medium-sized, 13.5–16 × 3–3.5 μ.

Mycosphaerella sphaerellula (Peck) Barr, comb. nov. Figures 123-124.

≡ *Sphaeria sphaerellula* Peck, Annual Rep. New York State Mus. 30: 66. 1878.
≡ *Didymella sphaerellula* (Peck) Sacc. Syll. Fungorum 1: 547. 1882.

Ascocarps 75–97 μ diam, globose conic, immersed and raising epidermis, connected and forming long lines with brown hyphae, the apices finally erumpent in small groups; wall relatively thin. Asci 27–50 × 9–12.5 μ. Ascospores 13.5–16 × 3–3.5 μ, hyaline, obovate fusoid, straight or inequilateral.

On thin twigs of *Acer pensylvanicum* L., eastern North America.

Material examined:

New York: Phoenicia, June 1876, *Peck* (type, NYS).

2. Series of *M. lineolata:* Ascospores large, (10.5–)15–24 × (2.5–)3–4.5(–5.5) μ.

Mycosphaerella lineolata (Rob. in Desm.) Schroet. in Cohn, Kryptogamenfl. Schlesien 3(2): 339. 1894. Figures 121–122.

≡ *Sphaeria lineolata* Rob. in Desm. Ann. Sci. Nat. Bot. II, 19: 351. 1843.
≡ *Sphaerella lineolata* (Rob. in Desm.) Ces. & de Not. Comment. Soc. Crittog. Ital. 1(4): 237. 1863.

Ascocarps 32–90(–105) μ diam, globose, conic, or slightly depressed, loosely or closely grouped, with brown connecting hyphae forming elongate grayish areas; wall thin. Asci 21–51 × 9.5–22 μ. Ascospores (12–)14–24 × 3–4.5(–5.5) μ, hyaline, fusoid or obovate fusoid, straight to inequilateral.

On overwintered leaves of *Carex* and *Juncus* spp., Europe, North America.

Barr (1959) published data on a number of collections of this species from the Canadian Eastern Arctic.

Mycosphaerella perexigua (Karst.) Johans. Öfver. Förh. Kongl. Vetensk.-Akad. 1884(9): 166. 1884.

≡ *Sphaerella perexigua* Karst. Hedwigia 11: 187. 1872.
= *Mycosphaerella perexigua* var. *minima* Johans. Öfver. Forh. Kongl. Vetensk.-Akad. 1884(9): 166. 1884.
≡ *Sphaerella perexigua* var. *minima* (Johans.) Berl. & Vogl. Addit. Syll. Fungorum 83. 1886; Syll. Fungorum 9: 653. 1891.

Ascocarps 32–75 μ diam, globose, scattered, with light brown connecting hyphae; wall thin. Asci 19–35 × 10.5–18 μ. Ascospores 10.5–22.5 × 2.5–3.5(–4.5) μ, hyaline, fusoid, straight or slightly curved.

On overwintered leaves of *Juncus, Luzula, Scirpus, Eriophorum* spp., Europe, North America.

Material examined:

Europe: Abisko, July 1930, *Lind* (MICH). North America: Northwest Territories: Head of Clyde Inlet, Baffin Island, 1 July, 8 July, 4 Aug 1950, *Dansereau* (DAOM, MASS). Newfoundland: Hebron, 30 July 1954, *Wilce* (DAOM, MASS). Quebec: Port Burwell, 17 Aug 1954, *Wilce* (DAOM, MASS).

Mycosphaerella capronii (Sacc.) Lind, Skr. Vidensk.-Selsk. Christiana, Math.-naturvidensk. Kl. 1909, no. 9: 16. 1910.

≡ *Sphaerella capronii* Sacc. Syll. Fungorum 1: 487. 1882.

Ascocarps globose, 66–115 μ diam, thickly grouped, hypophyllous; wall thin. Asci 30–48 × 10.5–13.5 μ. Ascospores 15.5–19.5(–21) × 3–4.5 μ, hyaline, fusoid, inequilateral or slightly curved.

On overwintered leaves of *Salix* spp., Europe, North America.

Material examined:

Newfoundland: Red Bay, Labrador, 23 June 1954, *Wilce* (DAOM, MASS).

Sphaerulina Sacc. Michelia 1: 399. 1878.

= *Ophiocarpella* Theiss. & Syd. Ann. Mycol. 13: 645. 1915.

Ascocarps usually uniloculate, scattered, grouped, or closely connected by brown hyphae, at times multiloculate, globose or conic, immersed or erumpent, opening by small apical pore; wall relatively thin, of two to five layers of brown polygonal cells, the cells thin- or thick-walled, usually forming *textura angularis,* the hyphae in host tissues brown, broad and short-celled. Asci oblong or clavate, bitunicate, in a fascicle from a low basal cushion; base footlike or rounded and sessile. Ascospores hyaline, minutely guttulate, in one, two or three overlapping fascicles in the ascus, cylindric filiform, straight or curved (the ends rounded), several-septate, not constricted at septa; wall thin, smooth.

Conidial state where known; *Septoria* (as *Cylindrosporium* or *Phleospora*): Pycnidia formed in spotted areas of living leaves, immersed-erumpent, the wall thin, often incomplete toward apex, opening widely at maturity; conidiophores as short hyaline cells lining locule; conidia hyaline, cylindric, usually curved, several-septate. Microconidial state *Asteromella*-like.

Parasitic or saprobic in leaves of woody dicotyledons.

Saccardo erected *Sphaerulina* for species similar to *Mycosphaerella* in ascocarp and asci, but with ascospores elongate and several-septate. He noted that *Sphaerulina* differed from *Leptosphaeria* section *Leptosphaerella* Sacc. in lacking pseudoparaphyses, in having hyaline ascospores, and in the sphaerellaceous habit. *S. myriadea* was the first species named in *Sphaerulina,* and this species agrees entirely with the original concept of the genus. Unfortunately, Saccardo also included *S. (Pringsheimia) intermixta* (Berk. & Br.) Sacc. in his concept of the genus, and some authors have taken this species to

typify *Sphaerulina,* especially since Winter (1887) illustrated the genus by this species. This name is a synonym of *Saccothecium sepincola* (Fr.) Fr. according to most authors. Wehmeyer (1957) discussed *Sphaeria intermixta* Berk. & Br., and considered the name to be a *nomen dubium.*

The species of *Sphaerulina* could be derived from those of *Mycosphaerella* subg. *Mycosphaerella* which I group in section *Longispora.* In these the ascospores are elongate, narrow, and taper to the ends. Longer and narrower ascospores with more septa characterize the species of *Sphaerulina.* Within this genus two series of species are evident: those which mature in overwintered leaves (but which may form leaf spots or blotches in the conidial or primordial state), and those which mature in living leaves. The ascocarps in all species are frequently grouped and in some collections they may be connected by abundant hyphae to form a stromatic complex. The most stromatic of these species, *S. tarda,* was the basis for the name *Ophiocarpella* Theiss. & Syd.

Kirschstein (1938) referred *Ophiosphaerella* Speg. to synonymy with *Sphaerulina.* I cannot pass judgment on the validity of this disposition at the present time.

Lectotype species: *S. myriadea* (DC. ex Fr.) Sacc.

1. Series of *S. myriadea:* Ascocarps maturing in dead overwintered leaves.

Sphaerulina myriadea (DC. ex Fr.) Sacc. Michelia 1: 399. 1878.

≡ *Sphaeria myriadea* DC. ex Fr. Syst. Mycol. 2: 524. 1823.
≡ *Sphaerella myriadea* (DC. ex Fr.) Auersw. in Gonnerm. & Rabenh. Mycol. Europ. 5/6: 9. 1869.
= *Sphaeria serograpta* Dur. & Mont. Flore d'Algerie 1: 537. 1846–49.
≡ *Sphaerella serograpta* (Dur. & Mont.) Auersw. in Gonnerm. & Rabenh. Mycol. Europ. 5/6: 12. 1869.
≡ *Sphaerulina serograpta* (Dur. & Mont.) Sacc. Syll. Fungorum 2: 187. 1883.
= *Sphaerulina myriadea* var. *viburni* Sacc. Syll. Fungorum 2: 186. 1883.
≡ *Sphaerella septorispora* Sacc. Ann. Mycol. 12: 287. 1914.
≡ *Mycosphaerella septorispora* (Sacc.) Petrak, Flor. Bohem. Morav. exs. II, Ser. 1 Abt. Pilz, no. 1026. 1914.

Ascocarps 90–150 μ diam, scattered to grouped in dull grayish blotches in overwintered leaves, epi- or hypophyllous. Asci 50–65 × 8–12 μ. Ascospores 25–32.5 × 2–3(–4) μ, 3-septate, in two overlapping fascicles in the ascus.

In leaves of *Quercus* and *Fagus* spp., Europe, Asia, North America.

Material examined:

Europe: *Krieger, Fungi sax. 279; Allescher & Schnabl, Fungi bavarici 441, 540, 541; Petrak, Flora moravica,* Mähr-Weisskirchen, 1915, *Myc. carpatica 67, Fungi polonici exs. 267, Fl. Bohem. et Morav. exs. 1026; Thümen, Fungi aust. 468; Herb. Barbey-Boissier 503; Thümen, Myc. univ. 2157.* North America: South Carolina: *Ravenel Fungi Amer. exs. 156.* (immature). Maryland: Marlboro, 26 Apr 1929, *Shear.* California: Hoberg's Resort, Lake Co., 15 May 1943, *Miller* (all BPI).

In the European collections examined the ascocarps are erumpent through the upper leaf epidermis, whereas in the North American material they are erumpent through the lower epidermis. All other characters are in agreement.

Sphaerulina tarda (Harkn.) Barr, comb. nov. Figures 125–126.

≡ *Ophiodothis tarda* Harkn. Bull. Calif. Acad. Sci. 1: 46. 1884.
≡ *Ophiodothella tarda* (Harkn.) v.Höhnel, Sitzungsber. Kaiserl. Akad. Wiss. Math.-Naturwiss. Kl. Abt. I, 119: 941. 1910.
≡ *Ophiocarpella tarda* (Harkn.) Theiss. & Syd. Ann. Mycol. 13: 645. 1915.

Ascocarps 60–150 μ diam, closely grouped and connected by brown hyphae to form circular or irregular stromatic masses 1–2 mm diam, chiefly hypophyllous; wall 11–17.5 μ thick. Asci 44–60 × 7.5–11 μ. Ascospores 35–50 × 1.5–3 μ, (1–2–)3-septate, in one fascicle in the ascus.

In overwintered leaves of *Rhus diversiloba* T. & G., western North America.

Material examined:

California: Golden Gate Park, San Francisco, March 1882, *Harkness* (type, CAS); San Francisco, Jan 1884 (NY); *Ell. & Ev. N.A.F. 1585.*

Sphaerulina rubi Demaree & Wilcox, Phytopathology 33: 997. 1943.

Ascocarps 70–130 μ diam, 88–140 μ high, globose or conic, scattered singly or grouped and forming small blackened patches, erumpent either epi- or hypophyllously, often connected in a thin stromatic crust by brown hyphae; wall up to 20–25 μ thick. Asci 45–60(–70) × 8–10(–15) μ. Ascospores 23–30 × 2.5–3.5 μ, 3 (–5–7)-septate, in two overlapping fascicles in the ascus.

Conidial state: *Septoria* (*Cylindrosporium rubi* Ell. & Morgan): Pycnidia developing in small angular spots in living leaves; spots brown, red margined; pycnidia 58–121 μ diam, 50–104 μ high, epi- or hypophyllous; wall thin, 12–15 μ thick; conidiophores arising from the inner wall surface as short cells 5 × 7.5 μ; conidia 32–86 × 2–5 μ, hyaline, cylindric, usually curved, 3–9-septate.

On leaves of *Rubus* spp., the conidial state widespread in living leaves, the ascal state known from North America, Europe.

Material examined (pro parte):

North America: Maryland: Beltsville, 7 May 1940, *Demaree* and *Wilcox* (type); 5 May 1940, *Demaree* (both BPI). Europe: Königstein, Germany, May 1897, *Krieger* (as *S. myriadea, S. rubi* Krieg. n.sp.?, PBI).

Specimens of the conidial state have been examined from Massachusetts, New York, Michigan, Washington, Ohio, Illinois, Oregon, North Carolina, Maryland, and Missouri.

Demaree and Wilcox (1943) established the connection between the conidial and ascal states of *S. rubi.* The type specimen bears small pycnidia interspersed with the ascocarps, as well as the overwintered *Septoria* state. The microconidial pycnidia are 50–60 μ diameter, hypophyllous, and contain minute hyaline microconidia.

The related *Sphaerulina rehmiana* Jaap develops on leaves of *Rosa* in Europe. Klebahn (1918) described the development of this fungus; included in the life cycle are microconidial and macroconidial states. Klebahn compared a number of collections and decided that the conidial state was *Septoria rosae* Desm. [*Phleospora rosae* (Desm.) v.Höhnel] .

2. Series of *S. conflicta:* Ascocarps maturing in spots in living leaves.

Sphaerulina conflicta (Cooke) Barr, comb. nov. Figures 127–129.

≡ *Sphaeria conflicta* Cooke, Grevillea 7: 13. 1878.
≡ *Linospora conflicta* (Cooke) Sacc. Syll. Fungorum 2: 355. 1883.

Ascocarps developing in spots in living leaves; spots visible on both leaf surfaces, brown or grayish brown, with reddish brown margins, circular or irregular in shape, ca. 5 mm diam, or connected and covering much of the leaf; ascocarps 140–170 μ diam, thickly scattered, globose, conic, or ovoid, erumpent epiphyllously, raising small flaps of epidermis, often lying obliquely in leaf tissues; wall 13–16.5 μ thick, up to 27.5 μ toward apex. Asci 75–96 × 11–13 μ. Ascospores 35–45 × 2–3 μ, 3 (–5)-septate, in two overlapping fascicles in the ascus.

On leaves of *Lithocarpus densiflora* (H. & A.) Rehd., western North America.

Material examined:

California: *Ell. & Ev. N.A.F. 1670; Fungi Columbiani 421; Rabenh.-Wint. Fungi eur. 3759*; Tamalpais, Streetens, *Harkness;* Mount Tamalpais, 1893, *Blasdale;* Mill Valley, 23 May 1893, *Blasdale;* Cazadiro, May 1894, *Bioletti* (all NY); Ross Valley, Marin Co., 11 Aug 1893, *Blasdale* (DAOM 18377).

Sphaerulina bonariana Petrak, Sydowia 15: 209. 1962 ["1961"].

Ascocarps 165–190 μ diam, 220–275 μ high, ovoid, grouped, widely erumpent epiphyllously, connected at the lower sides and forming groups up to 1 mm diam; surrounding leaf tissue dull brown or reddish brown as a narrow band around groups, occasionally included in large indeterminate or red-margined spots, usually raised into grayish brown flaps of epidermal cells over the groups; wall 18–25 μ thick. Asci 80–90 × 12–14 μ. Ascospores 32–45 × 3–4 μ, 3-septate, in two or three overlapping fascicles in the ascus.

On living leaves of *Castanopsis sempervirens* (Kell.) Dudl., western North America.

Material examined:

California: shore of Bear Lake, Plumas Co., 1 Aug 1942, *Bonas*; Alta Peak trail, Grant Forest, Sequoia Nat. Park, Tulare Co., 29 July 1945, *Bonar* (as *Calif. Fungi 725* and *726*, as *S. myriadea*, isotypes, BPI, NY; holotypes UC); Tulare Co., 18 June 1931; Sequoia Nat. Park, 18 June 1931, *Parks* (BPI).

Sphaerulina naumovii Vassiljeva, Bot. Mater. Otd. Sporov. Rast. Bot. Inst. Komarova Akad. Nauk SSSR 8: 94. 1952. Figures 130–131.

Ascocarps 82–115 μ diam, globose, few scattered and erumpent through either leaf surface, in brown leaves or brown tip portions of leaves in living branches, with brown connecting hyphae; wall 12–15 μ thick. Asci 39–60 × 12–15 μ. Ascospores 30–37.5 × 3–4 μ, 3–5-septate, in one fascicle in the ascus.

On *Cassiope hypnoides* (L.) D. Don, North America, Europe.

Material examined:

Europe: Jahkatsch, Lapponia enontekiensis, Finland, 31 July 1932, *Montell* (MASS). North America: New Hampshire: Mt. Washington, 25 June 1880, *Brown* (MASS).

I have not seen the original description of *S. naumovii*, but have grouped the above collections under that name because of similarities in host plants.

Dothidea Fr. Syst. Mycol. 2: 548. 1823, emend.

= *Systremma* Theiss. & Sydow, Ann. Mycol. 13: 330. 1915.
= *?Phragmodothis* Theiss. & Sydow, Ann. Mycol. 12: 179. 1914.

Ascocarps multiloculate, immersed at first, becoming erumpent, globose, pulvinate or irregular, composed of vertically oriented rows of polygonal cells forming *textura angularis*, blackened externally, brown to hyaline internally; cells mostly thick-walled with pit or pore connecting adjacent cells; locules immersed or partially erumpent; wall scarcely distinct from surrounding tissue or narrow and composed of few layers of cells, opening by a small apical pore in the short papillate apex. Asci arising in a fascicle from a basal cushion, oblong or clavate, bitunicate, very short stipitate or sessile, the ascospores eight or fewer. Ascospores overlapping biseriate (uniseriate when fewer than eight) in the ascus, hyaline at first, soon yellowish brown or dark brown, obovate elliptic, one-septate, constricted at the septum; wall usually finely roughened at maturity; globule one in each cell.

Conidial state: Conidia budding from cells of young stromata, from hyphae or from ascospores. In culture the hyphae form blackish gelatinous crusts, *Aureobasidium pullulans*-like. Microconidial locules have also been observed (Luttrell 1951a).

Usually saprobic, weakly parasitic at times, on branches or rarely leaves of woody plants, gymnosperms and dicotyledons, or on larger monocotyledons, widespread.

Consistency in minimizing the importance of stromatic development as a generic character requires a narrowed concept of *Dothidea*. The species I have retained in the genus are linked together by ascospore characters: broadly obovate elliptic in shape, brown at maturity, each cell containing a single globule, the wall usually roughened at maturity. Another characteristic possessed by this group of species is that of pores in the cell walls in the interior of young ascocarps, described by Luttrell (1951a) and

Loeffler (1957). That these species all form multiloculate ascocarps is a characteristic of lesser importance which may be found in a number of species belonging to other genera in the Dothideaceae. As an example, the formation of stromatic tissues and multiloculate ascocarps was not considered to be generically important when Petrak (1958a) transferred *Dothidella heucherae* and *D. janus* to *Mycosphaerella.*

There has been some conflict of opinion as to the type species of *Dothidea.* Fries (1823) did not designate a type species. Saccardo (1883) designated *D. sambuci* Fr. as type of the name. He limited *Dothidea* to brown-spored species and erected *Plowrightia* for hyaline-spored species. *D. sambuci* was generally accepted as typifying *Dothidea,* but Theissen and Sydow (1915) argued that *D. moriformis* Ach. ex Fr., the first species listed by Fries under *Dothidea* in 1823, should typify *Dothidea,* and they therefore erected *Systremma* based on *D. sambuci.* Since *D. moriformis* was considered by Fries (1828) only as a member of the "Dothideoideae," and was the basis for the genus *Kullhemia* Karst. 1878, it can scarcely be designated as the type species of *Dothidea. D. sambuci,* as one of the original species listed by Fries, and following customary usage ever since Saccardo in 1883, is the logical lectotype. *D. ribesia,* the type of *Plowrightia* Sacc., is again removed from *Dothidea* in the present interpretation of that genus. *Dothidella* sensu Theissen and Sydow (1915) has been used to accommodate hyaline-spored species, but von Arx (1958) showed *Dothidella* to be a microthyriaceous genus.

From Loeffler's (1957) arrangement of the species of *Dothidea* the hyaline-spored species are transferred to other genera. *D. muelleri* Loeffler is pleosporaceous in locule structure and related to *Scirrhodothis,* according to authentic Swiss material kindly communicated by Dr. Müller. *D. ribesia* Fr. and *D. insculpta* Wallr., both known from North America as well as from Europe, are members of the Dothioraceae, the former in *Dothiora,* the latter in *Scirrhia.* According to descriptions and figures of the other European species which Loeffler recognized in *Dothidea*—*D. mezerei* Fr., *D. berberidis* (Wahl.) de Not., and *D. hippophäeos* (Pass.) Fuckel—these too would be better placed in the Dothioraceae than in *Dothidea. D. concaviuscula* Ell. & Ev. also is removed from *Dothidea* to *Scirrhia,* while *D. parryi* Farlow from tropical America seems to be a species of *Mycosphaerella.*

Lectotype species: *D. sambuci* Fr.

Dothidea sambuci Fr. Syst. Mycol. 2: 551. 1823. Figures 132–134.

Loeffler (1957) provided an extensive synonymy of this species.

Ascocarps variable in size and shape. Asci 36–60 × (10–)13–24 μ, 8-spored. Ascospores 13–34 × (5.5–)7–11 μ, brown, broadly elliptic.

On numerous woody dicotyledons, Europe, North America; weakly parasitic on leaves as well as branches of *Garrya* spp., North America.

Material examined (pro parte):

California: *Calif. Fungi 1146* (NY); Berkeley, *Harkness* (on specimen of *Sphaeria garryae* Cke., NY).

Dothidea puccinioides Fr. Syst. Mycol. 2: 551. 1823. Figures 135–136.

Loeffler (1957) provided synonymy of this species. *Dothidea calystegiae* Cooke & Harkn. Grevillea 13: 8. 1884, is probably an additional synonym. The type specimen is immature but ascocarps and young locules are identical with other specimens of *D. puccinioides.*

Ascocarps variable in size. Asci 48–60 × 12–15 μ, the spores 4 or fewer. Ascospores (14.5–)18–34 × (6–)8–14 μ, brown, broadly elliptic.

On numerous woody dicotyledons, Europe, North America.

Material examined (pro parte):

California: *Harkness 2477* (type of *D. calystegiae,* CAS). New Jersey: *Ellis N.A.F. 168a, 168b; Ell. & Ev. Fungi Columbiani 1331.*

Dothidea conspicua Griff. Bull. Torrey Bot. Club 26: 442. 1899.

≡ *Phragmodothis conspicua* (Griff.) Theiss. & Syd. Ann. Mycol. 12: 179. 1914.

= *Dothidea yuccae* Earle, Bull. New York Bot. Gard. 2: 346. 1902 (Apr), *non Phyllachora yuccae* Ell. & Ev.

= *Dothidea yuccae* Ell. & Ev. J. Mycol. 8: 19. 1902 (May), *non Phyllachora yuccae* Ell. & Ev.

≡ *Phaeodothis yuccae* (Ell. & Ev.) Sacc. Syll. Fungorum 17: 855. 1905.

≡ *?Systremma yuccae* (Ell. & Ev.) Theiss. & Syd. Ann. Mycol. 13: 337. 1915.

Ascocarps immersed erumpent, rounded or elongate, 250–500 μ diam or up to 1100 μ long, 200–275 μ high; locules 50–143 μ diam, 70–150 μ high. Asci 55–70(–80) × 12–16(–22) μ, 8-spored. Ascospores 13–21 × (5–)6–8.5 μ, dull yellowish brown or dark brown, broadly obovate, slightly constricted at the septum; wall finely roughened.

On dead leaves of *Yucca* spp., western North America.

Material examined:

Montana: Billings, Aug 1898, *Griffiths, West Amer. Fungi 43* (isotype of *D. conspicua*). Wyoming: *Mycoflora Saximont. Exs. 126* as *Didymosphaeria clementsii* (NY, with *Venturia weiriana*). Colorado: Manitou, July 1895 (NY, basis for *Dothidea yuccae* Ell. & Ev.). California: Soledad Canyon, 19 May 1935, *Plunkett* (NY, as *Plowrightia circumscissa*); Stanford Univ., 20 Oct 1901, *Baker* (NY, basis for *Dothidea yuccae* Earle); Mts. near Claremont, 12 Mar 1911, *Baker* and *Metz* (NY, as *Phaeodothis yuccae*).

The names *Dothidea yuccae* Earle and *D. yuccae* Ell. & Ev. were both based on the assumption that *Phyllachora yuccae* Ell. & Ev. Bull. Torrey Bot. Club 22: 440. 1895, was the same fungus in immature condition. Type material of the latter (Matamoros, Mexico, June 1895, *Egeling,* NY) is rather immature *Kellermania anomala* (Cooke) v.Höhnel. The "asci" of the original description are the elongate conidia of the *Kellermania,* some sufficiently matured to have a septum and the typical apical appendage.

Theissen and Sydow (1914) erected *Phragmodothis* on the basis of *Dothidea conspicua* Griffiths and described biseriate, blackish brown, 3-septate ascospores 20–24 × 5–6 μ. Neither the collections cited above nor any of the numerous other specimens of *Yucca* which I have examined bore any fungus fitting the description of *Phragmodothis.* The nearest possibility is a species of *Karstenula* found on Solheim's *Mycoflora Saximont. exs. 126,* but that fungus has separate ascocarps, cylindric asci containing uniseriate ascospores which have three transverse septa and a vertical septum through the mid cells.

Petrak (1929) described another fungus he found on the substrate of *Kellermania yuccaegena* (Brenckle, *Fungi Dakotensis 438*), which had locules in an erumpent stroma, cylindric asci, blackish brown, three-septate ascospores 16–20(–24) × 5–6.5 μ. He concluded that it was identical with *Phragmodothis conspicua* Theiss. & Syd., and that it was a species of *Cucurbitaria,* and he transferred it to *Thyridaria.* He then reduced *Phragmodothis* to a synonym of *Thyridaria.* Wehmeyer (1941) did not accept that species in *Thyridaria,* because he too found *Dothidea conspicua* to be dothideaceous. The specimens of Brenckle's *Fungi Dakot. 438* which I have examined (from BPI and NY) bear *Kellermania anomala, Coniothyrium* sp., and *Mycosphaerella acervata.* Petrak later (1941) discussed *Plowrightia circumscissa* Tracy & Earle, which Theissen and Sydow (1915) had transferred to *Phragmodothis.* Petrak reported that the hyaline, one-septate ascospores described by Tracy and Earle were immature; at maturity the spores were biseriate, olive-brown, 3-septate, 18–20 × 5–6 μ. He included *P. circumscissa* in the synonymy of *Thyridaria conspicua,* with the host plant *Yucca gloriosa.* The only specimen bearing the name of *P. circumscissa* which I obtained from NY (*Plunkett,* California, see above) has spots containing *Mycosphaerella acervata,* and non-spotted dead areas of leaves containing *D. conspicua.* Holm (1968) found *Dothidea conspicua* to be as Griffiths described it. He suggested that Theissen and Sydow confused two species in describing *Phragmodothis,* as I too believe must have happened.

Holm also suggested that *Phaeosphaerella weiriana* Petrak [*Venturia weiriana* (Petrak) Barr] might be a uniloculate form of *D. conspicua.* However, there are discrete differences between the two fungi, which often occur on the same dead leaves. *V. weiriana* has separate ascocarps which may be grouped in the leaf, are often depressed and remain immersed. Sparse delicate pseudoparaphyses are interspersed between asci in the locule. Asci and ascospores are quite similar in size and shape in the two species, although in *V. weiriana* the ascospores tend always to be smaller (10–12 × 4.5–5.5 μ), than they are in *D. conspicua.*

Dothidea acerva Barr, sp. nov. Figures 137–140.

Ascocarpia 350–650 μ diametro, 150–220 μ alta, erumpentia; hypostroma in contextu hospitis; loculi 40–60 μ diametro infra paginam stromae. Asci 22–27.5 × 9–11 μ, oblongi vel saccati, bitunicati. Ascosporae 6.5–9 × 2–4 μ, viridi-hyalinae vel fuscae, ellipticae vel obovatae, uniseptatae.

Specimen typicum in foliis, ramulis, et amentis pistillatis *Juniperi communis,* prope "Conway, Massachusetts, 22 May 1966" a *M. E. Barr* n. *4821* lectum, in Herb. Univ. Mass. depositum.

Ascocarps multiloculate, pulvinate, 350–650 μ diam, 150–220 μ high, erumpent from the host tissue, brown; hypostroma in host tissues; locules over the surface, 40–60 μ diam, globose to conic; wall of two to three layers of polygonal blackish brown cells, 9–11 μ thick, merging at base with stromatic tissue in upright rows of polygonal cells; apex short papillate or nearly plane, opening by a small pore. Asci 22–27.5 × 9–11 μ, oblong or saccate. Ascospores 6.5–9 × 2–4 μ, greenish hyaline becoming brown, elliptic or obovate, the ends broadly rounded; septum median or slightly submedian, constricted; wall very finely roughened at maturity; globule solitary in each cell or the contents homogeneous.

On dead leaves, branches and pistillate aments of *Juniperus communis* L., eastern North America.

Material examined:

New Hampshire: *Barr 4027* (MASS). Massachusetts: *Barr 2690, 4813, 4821* (type) (MASS).

The Massachusetts collections were all made from a single large plant. None of the nearby shrubs bore the fungus. The species grew rapidly in culture, particularly on malt agar, to form a moist black colony. In the colony numerous stromatic masses developed and budding hyaline conidia were produced on their surface. The growth habit is similar to that of *Aureobasidium pullulans.* No ascocarps were formed in culture. The conidial state as formed in culture appears close to that produced by *Kabatina juniperi* (Schneider & von Arx 1966). The latter fungus forms erumpent acervuli on branches of *Juniperus* in Europe. No such acervuli were found on the North American collections.

Attempts to identify this species with others previously described from *Juniperus* were unsuccessful. *Dothidella juniperi* (Desm.) v.Höhnel has few locules in small stromata, narrow asci and narrow fusoid ascospores. It is probably a species of *Mycosphaerella. Sphaerella fructinex* Kirschstein, according to description, differs from *D. acerva* in having separate ascocarps and narrow fusoid ascospores, and would be a species of *Mycosphaerella,* perhaps not differing from *Dothidella juniperi. Dothidea sphaeroidea* Cooke is the type species of *Coccodothis* Theissen & Sydow, a member of the Patellariaceae.

Rhizogene H. & P. Sydow, Ann. Mycol. 18: 181. 1920.

Ascocarps multiloculate, superficial from a subcuticular crustose hypostroma; hyphae penetrating leaf and branch tissue, forming yellowish spots on living leaves; ascocarps flattened, rounded or elongate, scattered or grouped, composed of vertically oriented rows of polygonal cells forming *textura angularis,* blackened toward the

surface, light brown internally; blunt tipped brown hyphae arising from the surface, especially from sides and lower surface; locules marginal, immersed, often visible as depressions in the stroma, usually horizontal; apical pore small. Asci oblong, bitunicate, sessile or the base foot-like, arising from a low basal cushion of hyaline cells. Ascospores overlapping biseriate in the ascus, hyaline, soon light dull brown, broadly elliptic or obovate; septum supramedian, usually slightly constricted; upper cell conic, the lower cell oblong or ovoid or nearly cylindric; wall smooth or finely roughened; contents homogeneous.

Conidial state unknown.

Parasitic on leaves and branches of woody dicotyledons, middle and western North America.

Although Müller and von Arx (1962) included *Rhizogene* in the Venturiaceae, the aspect of young and mature locules is dothideaceous and this genus seems better arranged among the Dothideaceae.

Type species: **R. impressa** (Ell. & Ev.) Barr.

Rhizogene impressa (Ell. & Ev.) Barr, comb. nov. Figures 141–144.

≡ *Karschia impressa* Ell. & Ev. Bull. Torrey Bot. Club 24: 470. 1897.
= *Lasiobotrys symphoricarpi* H. & P. Sydow, Ann. Mycol. 16: 244. 1918.
≡ *Rhizogene symphoricarpi* (H. & P. Sydow) H. & P. Sydow, Ann. Mycol. 18: 181. 1920.

Ascocarps 245–450 μ diam, 75–155 μ high; locules 70–100 μ high, 60–70 μ diam; wall thin, ca. 6.5 μ thick. Asci 35–55 × 8–11 μ. Ascospores 9–12 × 4.5–5.5 μ.

Parasitic, mostly hypophyllous on leaves, also on branches of *Symphoricarpos* spp., middle and western North America.

Material examined (pro parte):

Colorado: Pagosa, San Juan Mts., July 1897, *Bethel 356* (type of *Karschia impressa,* NY, BPI); San Juan Mts., July 1897, *Ell. & Ev. N.A.F. 3518* as *Lasiobotrys lonicerae* form *symphoricarpi* (isotype of *L. symphoricarpi*).

Several additional collections from Colorado, and others from Saskatchewan, Montana, Idaho, Wyoming, Utah, and California, have been examined. Many of these are immature and the locules are filled with hyaline cells or young asci. *Rhizogene impressa* is located in various herbaria under the unpublished names *Lasiobotrys lonicerae subcircinata* Ell. & Ev. ined., *L. subcircinata* Ell. & Ev. ined., *L. lonicerae* f. *symphoricarpi* Ell. & Ev. ined.

H. and P. Sydow based their original description of *Lasiobotrys symphoricarpi* on *Ell. & Ev. N.A.F. 3518.* The fungus in this exsiccatus is immature. Von Höhnel (1919) also examined immature specimens and noted that the hiatus between this taxon and *L. lonicerae* could be generic. The following year H. and P. Sydow erected *Rhizogene* for *L. symphoricarpi,* still based on immature specimens. Müller and von Arx (1962) were the first to provide details of asci and ascospores. The type material of *Karschia impressa* is on branches of *Symphoricarpos,* but differs in no other respect from the leaf-inhabiting form of the fungus.

Lasiobotrys Kunze, Mycol. Hefte 2: 88. 1823.

Sclerotial ectostromata grouped and forming small black areas on leaf spots or on thin branches, originating from a subcuticular, crustose hypostroma from which hyaline hyphae penetrate deep into host tissues; ectostroma rounded, flattened, black, composed of vertically oriented rows of cells forming *textura angularis,* blackened externally, hyaline to yellowish internally, the surface bearing down-hanging brown hyphae; ascocarps uniloculate, in hyphae at the lower sides of the ectostroma, globose, small; wall thin. Asci oblong or saccate, bitunicate, sessile, in a fascicle from the base of the locule. Ascospores overlapping biseriate in the ascus, greenish hyaline to light brown, elliptic to obovate; septum supramedian, usually slightly constricted; upper cell

conic, the lower cell elliptic or ovoid; wall smooth; contents homogeneous or minutely guttulate.

Parasitic on leaves and branches of woody dicotyledons, widespread.

Petrak (1927) and Müller and von Arx (1962) considered *Lasiobotrys* to be a member of the Venturiaceae. However, both the aspect of immature locules, and all that is known concerning stages of development (Arnaud 1925, Killian 1938) indicates that *Lasiobotrys* has a *Dothidea* type of development and must be placed in the Dothideaceae. Killian (1938) described and illustrated the development of ascocarps in a sequence: (1) formation of subcuticular hypostroma, (2) ectostroma produced by numerous divisions of the hypostromatic cells, (3) origin of free hyphae and ascocarps from division of certain epidermal cells on the lower sides of ectostroma, (4) ascocarps enlarged by cell divisions, resulting in differentiated wall and interior, (5) formation of ascogonial hyphae, followed by nuclear pairing, production of primitive croziers, and binucleate proasci within the young ascocarp.

Type species: *L. lonicerae* (Fr.) Kunze.

Lasiobotrys lonicerae (Fr.) Kunze, Mycol. Hefte 2: 88. 1823. Figures 145–147.

= *Lasiobotrys affinis* Harkn. Bull. Calif. Acad. Sci. 1: 42. 1884.

Müller and von Arx (1962) provided detailed synonymy of *L. lonicerae.* A number of morphological forms have been described. Until additional evidence is available, only one variable species is recognized in the genus.

Leaf spots 3–10 mm diam, yellowish or grayish, slightly hypertrophied and raised, often with reddish margin; sclerotial ectostromata 135–350 μ diam, 125–200 μ high; ascocarps (30–)52–120 μ diam. Asci 30–63.5(–70) × 11.5–15 μ. Ascospores 10–17 × 4.5–6.5(–8) μ.

Parasitic, mostly epiphyllous on leaves and on thin branches of *Lonicera* spp., Europe, North Africa, Asia, western North America.

Material examined:

British Columbia: Owl Creek, 25 June 1951, *Hansbrough* (BPI, NY). Idaho: *Henderson 4353* (BPI); Spirit Lake, 4 Sept 1920, *Rhoads* (BPI); Potlatch, 15 Sept 1920, *Stillinger* (BPI); Musselshell Ranger Station, 15 July 1924 (BPI); *Weir 20084* (BPI). Washington: *Suksdorf's Flora of Washington 269* (NY); *Ell. & Ev. N.A.F. 3107, Fungi Columbiani 510.* Wyoming: *Nelson, Flora of Wyoming 4112* (BPI). Oregon: Jefferson, 3 Apr 1934, 3 July 1934, *Bailey* (BPI, NY); Lake Mt. trail, Oregon caves, 12 Aug 1929, *Darker* (DAOM); Crater Nat. Park, 6 Aug 1930, *Goodding* (NY); Talent, 20 June 1915, *Posey* (NY); Woldport, Aug 1934, *Zeller* (NY). California: Hayward Canyon, 25 Nov 1922, *Bain* and *Fields* (BPI); *Baker, Plants of the Pacific Coast 1820, 2695* (NY); Los Gatos Canyon, Santa Clara Co., 29 Dec 1923, *Bonar* (MICH); *Beattie 5925* (BPI); Bear Gulch Road, 3 Dec 1893, *Dudley* (BPI); *Harkness 2539* (type of *L. affinis,* CAS), Tamalpais, June 1883, *Harkness* (NY); *Parks, Calif. Fungi 273* (BPI, MICH, NY); near Granville Lake, 19 Apr 1903, *Thompson* (BPI); *Tracy 6874, 15115* (BPI, MICH).

In the type specimen of *Lasiobotrys affinis* Harkness, a number of the sclerotial ectostromata contain a cavity into which conidiophores protrude. The latter are short and simple or elongate and bear short side branches. Microconidia are abstricted from tips of branches or from apices of conidiophores, are hyaline at first, becoming light brown, 2.5–3.5 × 1.5–2 μ, elliptic, one-celled.

Bonar (1928) described a conidial fungus which developed from single ascospores on agar medium. A scanty brown to black aerial mycelium was produced in culture, forming conidiophores as erect dark hyphae. Conidia arose singly at the apex and were pushed aside by elongation of the conidiophore, from the new apex producing another conidium. Conidia were globose or elliptic, one-celled and subhyaline at first, becoming transversely and vertically septate, brownish black with wall tubercular-roughened, at maturity reaching a size of 25 × 12–15 μ. The fungus would seem to be related to *Cladosporium.*

Von Höhnel (1919a) distinguished four species of *Lasiobotrys* on the basis of four

different supposed conidial states which belonged to the genera *Colletotrichella* and *Kabatia.* Müller (1953a, 1957, 1959b) proved by cultural studies that these conidial states were part of the life cycle of three species of *Guignardia* (i.e. *Discosphaerina*), and that they had no connection with *Lasiobotrys.*

Herpotrichiellaceae Munk, Dansk Bot. Arkiv 15(2): 131. 1953; 17(1): 438. 1957.

Ascocarps uniloculate, globose, conic, or depressed, superficial or immersed erumpent; wall thin, of few layers of somewhat compressed dull gray brown or olivaceous cells; surface often roughened by short blackish brown setae or protruding cells; apical pore small, stuffed with small pallid or brownish cells at first. Asci oblong or saccate, arising in a fascicle from the base of the locule, aparaphysate, bitunicate, octo- or polysporous. Ascospores crowded or overlapping biseriate in the ascus, hyaline becoming dull olivaceous, grayish brown or dark dull brown, oblong, elliptic, fusoid, or elongate, straight to curved, one- to several-septate, frequently with a vertical septum in one or more cells; cells containing several minute guttules or one large globule; smooth, without gelatinous coating.

Conidial state unknown.

Saprobic, often hypersaprobic on old fungi, or on decayed wood or herbaceous stalks and leaves.

Munk (1953) erected this family to accommodate *Herpotrichiella, Capronia,* and *Berlesiella* and his new genera *Didymotrichiella* and *Dictyotrichiella.* He stressed as characteristic the minute size and often hypersaprobic nature of the ascocarps, as well as the dull grayish or olivaceous brown colors of the wall and of the ascospores. Müller and von Arx (1962) included *Herpotrichiella* in the Pleosporaceae and did not recognize the Herpotrichiellaceae as a separate family. They expressed doubts as to the validity of genera based solely on ascospore septation, because of variability within species, and combined *Didymotrichiella* with *Herpotrichiella.* Earlier (in Bigelow & Barr 1963), I agreed with Müller and von Arx and relegated species of *Herpotrichiella* to the Pleosporaceae. Now I must reverse my stand and uphold the family Herpotrichiellaceae for those taxa which appear to have a *Dothidea* type of development according to structure of the mature locule.

However, not all of the taxa included in the Herpotrichiellaceae by Munk are of this type. As Shoemaker (pers. comm.) suggested, the species of *Dictyotrichiella* have short apical pseudoparaphyses, and must be considered to exhibit a variation of the *Pleospora* developmental type. The appearance of the locule apex in these species is much like that in species which have been classified in the Capnodiaceae (Corlett 1970). Re-examination of the specimens which were listed under *Berlesiella nigerrima* (Barr in Bigelow & Barr, 1969) revealed that short apical pseudoparaphyses were present in all of the collections cited. Thus, *Berlesiella* and its type species must be transferred to the Pleosporales. *Herpotrichiella setosa* Barr (1959) has apical pseudoparaphyses also and must be removed from this genus. According to Petrak's original description (1914), and by analogy with species that appear to be closely related, *Herpotrichiella* lacks apical pseudoparaphyses and has a locule of the Dothidea type. Perhaps the taxa removed from the Herpotrichiellaceae could be accommodated in the Dimeriaceae; further studies of the complex situation in the Pleosporales are needed before their disposition can be ascertained.

The small number of species recognized here as dothideaceous and grouped in the Herpotrichiellaceae are distinguished generically on the bases of ascospore shape and the possession of octo- or polysporous asci. *Herpotrichiella* has octosporous asci and the fusoid elliptic ascospores are usually several-septate and may have a vertical septum in one or more cells. *Capronia* has polysporous asci and the fusoid elliptic ascospores are several-septate with a vertical septum in several cells. The new genus *Polytrichiella* is described for those species which have polysporous asci whose ascospores are narrowly fusoid or elongate, one- to several-septate, and lack a vertical septum.

Key to Genera

1. Asci octosporous; ascospores elliptic fusoid, (one–)several-septate, often with vertical septum. *Herpotrichiella*
1. Asci polysporous.
   2. Ascospores elliptic fusoid, several-septate, usually with vertical septum. *Capronia.*
   2. Ascospores narrowly fusoid or elongate, one- or several-septate, without vertical septum. *Polytrichiella.*

Herpotrichiella Petrak, Ann. Mycol. 12: 472. 1914.

Ascocarps globose or conic, rarely depressed, superficial, scattered; surface setose or roughened by protruding cells; wall thin, dull brownish or grayish. Asci oblong or saccate, octosporous, bitunicate. Ascospores hyaline, soon light olivaceous brown or grayish brown, fusoid or elliptic; one- to several-septate, often with vertical septum in one or more cells.

Saprobic or hypersaprobic, on old wood, other fungi, or leaves and branches of woody plants.

Müller and von Arx (1962) included *Didymotrichiella* Munk as a synonym of *Herpotrichiella.* However, their description of *H. inconspicua* (Munk) Müller and von Arx, the type species of *Didymotrichiella,* included pseudoparaphyses. Since I have not seen this species, I cannot synonymize *Didymotrichiella* with *Herpotrichiella.*

Type species: *H. moravica* Petrak, Ann. Mycol. 12: 472. 1914.

On rotting *Fagus* wood, Europe. For description see Petrak (1914) and Munk (1957).

Additional species:

Herpotrichiella parasitica (Ell. & Ev.) Barr, comb. nov. Figures 148–150.

≡ *Melanomma parasitica* Ell. & Ev. Proc. Acad. Nat. Sci. Philadelphia 42: 240. 1891 ["1890"].

Ascocarps 120–150 μ diam, globose or conic; wall thin, ca. 10 μ thick, dull brownish, covered with short setae or protruding cells 10–22 μ long. Asci 35–40 × 7.5–10 μ, oblong. Ascospores 9–11 × 3.5–4 μ, dull grayish brown, elliptic fusoid, tapered to slightly pointed ends, straight to inequilateral, 3-septate, not or slightly constricted at the septa; contents guttulate.

On old stromata of *Diatrype* sp., eastern North America.

Material examined:

New Hampshire: *Barr 3876, 3877* (MASS). New Jersey: *Ell. & Ev. N.A.F. 2367.*

This species appears to be closely related to the type species. *H. moravica* has somewhat more elongate setae and slightly longer ascospores (10–14 × 3–4 μ), than does *H. parasitica.* The latter has a plushy aspect under the dissecting microscope, due to the very short setae.

Herpotrichiella spinifera (Ell. & Ev.) Barr in Bigelow & Barr, Rhodora 65: 300. 1963.

On and partially immersed in hymenia of old Basidiomycetes, North America. For description and synonymy see Bigelow & Barr (1963).

Herpotrichiella pilosella (Karst.) Munk, Dansk Bot. Arkiv 17(1): 438. 1957.

≡ *Sphaeria pilosella* Karst. Mycol. Fenn. 2: 96. 1873.
≡ *Melanomma pilosella* Karst. in Sacc. Syll. Fungorum 2: 114. 1883.

Ascocarps 90–200 μ diam, globose depressed, scattered or grouped on a thin weft of hyphae; wall 7.5–10 μ thick, of 2–3 layers of slightly compressed cells, bearing blackish brown setae over the upper half; setae (10–)20–55(–65) μ long, 3–5 μ wide near base, tapering to blunt points, straight or sinuous, one-celled or septate. Asci

44–45 × 10–15.5 μ, oblong or saccate. Ascospores 11–15.5 × 3.5–5(–6) μ, elliptic obovate, straight or inequilateral with rounded ends, (1–2–)3-septate, not constricted at septa; vertical septum present in mid cells at times, contents minutely guttulate.

On old wood of *Betula, Salix,* Europe, North America.

Material examined:

Quebec: *Barr 2920* (MASS). New Hampshire: *Barr 4063B* (MASS). Idaho: *Slipp 681* (MASS).

Herpotrichiella fusispora Barr, Contr. Inst. Bot. Univ. Montréal 73: 28. 1959.

On dead leaves and branches of *Cassiope* and *Phyllodoce* spp., North America.

For description see Barr (1959). Two collections on *Cassiope* from British Columbia (*Barr 647, 683,* MASS) are referable to this species. The ascocarps are usually setose, but occasionally the wall is only roughened by protruding cells. Ascospores which in the type material are 13.5–20(–27) × 3–5 μ and 1- to 5-septate, measure 22–33 × 4.5–5.5 μ in the western collections, and are 5- to 7-septate. In all collections the ascospores are fusoid and may be straight or curved.

Capronia Sacc. Syll. Fungorum 2: 288. 1883.

Ascocarps superficial on a thin weft of hyphae, globose or conic; surface roughened by short setae or protruding cells; wall thin. Asci usually saccate, polysporous. Ascospores hyaline to dull brown, elliptic or fusoid, often inequilateral, usually with vertical septum in one or more cells, minutely guttulate.

On woody stalks or branches, Europe, North America.

Type species: *C. sexdecemspora* (Cooke) Sacc.

For description see Saccardo (1883).

Additional species:

Capronia irregularis Barr, sp. nov. Figures 151–152.

Ascocarpia 82–130 μ diametro, globosa, peridio 10 μ crasso, superficie papilloso. Asci 39–67 × 21–39 μ, saccati vel ovati, bitunicati, 32-spori. Ascosporae 15–22.5 × (5–)6–9 μ, hyalinae vel obscurae olivaceo-brunneae, elliptico-fusoideae, (3–)5 (7–)-septate et septo verticali instructae.

Specimen typicum in ramulis emortuis *Empetri nigri,* prope "top of Mont Albert, Gaspé Provincial Park, Quebec, 8 July 1957," a *M. E. Barr* lectum, n. *1970*; in Herb. Univ. Mass. depositum.

Ascocarps 82–130 μ diam, globose; surface roughened by projecting thick walled cells; wall dull grayish brown, darker in upper portion, ca. 10 μ thick. Asci 39–67 × 21–39 μ, saccate or ovate, 32-spored. Ascospores 15–22.5 × (5–)6–9 μ, hyaline, soon dull grayish or olivaceous brown, elliptic fusoid, tapered to blunt or pointed ends, straight or inequilateral, (3–)5 (–7)-septate, not constricted at septa; vertical septum one in each cell, usually oblique in the end cells; secondary transverse septa often irregularly inserted.

On dead branches of *Empetrum nigrum* L., *Rhododendron lapponicum* (L.) Wahlenb., eastern North America.

Material examined:

Quebec: *Barr 1970* (type), *2275* (MASS).

Rather than by setae protruding from the wall of the ascocarp, the surface is irregularly roughened by protruding cells.

Polytrichiella Barr, gen. nov.

Ascocarpia globosa, conica, vel depressa, erumpentia vel superficialia, peridio tenui, superficie setoso. Asci oblongi, ovati vel saccati, bitunicati, polyspori. Ascosporae hyalinae vel dilute olivaceae vel fumosae, fusoideae vel elongatae, uni- vel pluri-septatae.

Species typicum: *P. polyspora* (Barr) Barr.

Ascocarps globose, conic or depressed, erumpent to superficial, seated on a thin weft of brown hyphae; wall thin, dull grayish brown, with short to elongate setae over the upper half; setae blackish brown, pointed, straight or curved, one-celled or occasionally septate; apical pore small. Asci oblong, ovate, or saccate, bitunicate, polysporous. Ascospores crowded or in a fascicle in the ascus, hyaline to light olivaceous or grayish brown, fusoid or elongate, 1- to several-septate, not constricted at septa; contents minutely guttulate.

Saprobic on woody or herbaceous plants, North America.

The taxa described in this genus all have polysporous asci as in *Capronia,* and narrow fusoid or elongate ascospores. The ascospores of the type species are broad and at times resemble those of species of *Herpotrichiella.* However, the species form a sequence in which ascospore shape varies from elliptic fusoid to elongate fusoid, nearly cylindric.

Polytrichiella polyspora (Barr) Barr, comb. nov.

≡ *Herpotrichiella polyspora* Barr, Contr. Inst. Bot. Univ. Montréal 73: 29. 1959.

On *Cassiope tetragona* (L.) D. Don, *Empetrum nigrum* L., North America.

For description see Barr (1959). This species with approximately 32 ascospores in an ascus exhibits variability in ascospore size and septation, even in a single collection. The range of ascospore sizes is (6–)9–18 × (2–)3–4.5(–7) μ, and the elliptic fusoid ascospores may be 1-, 2-, or 3-septate.

Additional species:

Polytrichiella albimontana Barr sp. nov. Figures 153–155.

Ascocarpia 70–90 μ diametro, 60–80 μ alta, globoso-depressa, peridio 5.5–7.5 μ crasso; setae numerosae, 16–44 μ longae, recurvatae. Asci 33–46 × 11–16.5 μ, oblongi, bitunicati, sexdecemspori. Ascosporae 17.5–27.5 × 1–2(–2.5) μ, hyalinae, fusoideae, curvatae, uniseptatae.

Specimen typicum in floribus emortuis *Gei peckii,* prope "Lake of the Clouds, Mt. Washington, New Hampshire, 23 July 1963," a *M. E. Barr* n. *3965* lectum; in Herb. Univ. Mass. depositum.

Ascocarps 70–90 μ diam, 60–80 μ high, globose or depressed, erumpent superficial; wall 5.5–7.5 μ thick; setae numerous over upper portion of wall, 16–44 μ long, 2.5–4 μ thick near base, blackish brown, curved, pointed. Asci 33–46 × 11–16.5 μ, 16-spored. Ascospores in a fascicle in the ascus, 17.5–27.5 × 1–2(–2.5) μ, hyaline, fusoid, usually curved, 1-septate in the middle, not constricted, the upper cell broader than the lower.

On overwintered flower heads of *Geum peckii* Pursh, eastern North America.

Material examined:

New Hampshire: *Barr 3965* (type, MASS).

Recurved setae and shape of the ascospores distinguish this species from others of the genus.

Polytrichiella longispora Barr sp. nov. Figure 156.

Ascocarpia 60–120 μ diametro, globosa, peridio 5.5–9 μ crasso; setae apicales, usque ad 40 μ longae. Asci (33-)55–62 × (7.5–)10–13.5 μ, oblongi, bitunicati, sexdecemspori. Ascosporae 46–60 × 1.5–2(–2.5) μ, hyalinae, elongato-fusoideae, curvatae, (3–)5–7-septatae.

Specimen typicum in pedunculis emortuis *Leptarrhenae pyrolifoliae,* prope "Garibaldi Provincial Park, British Columbia, 8 Aug 1952," a *M. E. Barr* n. *687A* lectum; in Herb. Univ. Mass. depositum.

Ascocarps 60–120 μ diam, globose, erumpent superficial; wall 5.5–9 μ thick; setae few to numerous around apex, short or up to 40 μ long, blackish brown, pointed. Asci (33–)55–62 × (7.5–)10–13.5 μ, oblong, 16-spored. Ascospores in a fascicle or coiled in the ascus, 46–60 × 1.5–2(–2.5) μ, hyaline, elongate fusoid (the upper portion somewhat broader than the lower, slightly curved), tapered to pointed ends, (3–)5–7-septate, not constricted; contents minutely guttulate.

On overwintered peduncles of *Leptarrhena pyrolifolia* (D.Don) R.Br., western North America.

Material examined:

British Columbia: *Barr 687A* (type, MASS).

The elongate ascospores in *P. longispora* are long fusoid rather than filiform and are pointed at both ends.

Capnodiaceae (Sacc.) v.Höhnel, Sitzungsber. Kaiserl. Akad. Wiss. Math.-Naturwiss. Kl. Abt. 1, 119: 625. 1910.

= *Perisporiaceae* subfam. *Capnodiaceae* Sacc. Syll. Fungorum 1: 73. 1882.
= *Capnodiales* Woronichin, Ann. Mycol. 23: 177. 1925.

Ascocarps uniloculate, superficial on a thin or well developed massive subiculum of hyphae; hyphae interwoven and anastomosed, dark brown, thick walled, cylindric, the walls smooth or roughened; ascocarps globose, conic, or elongate and sterile at base; wall thin, dark brown, rarely light or bright colored, composed of few layers of polygonal cells, glabrous or bearing cylindric, septate hyphal appendages; apical pore small. Asci saccate, oblong, elliptic or clavate, bitunicate, in a fascicle from the base of the locule, usually octosporous, aparaphysate. Ascospores crowded in the ascus, hyaline or brown, variable in shape and septation; contents with one or more globules; wall smooth or roughened, rarely surrounded by a gelatinous coating.

Conidial states variable: Pycnidial state: pycnidia closely associated with and similar in aspect to ascocarps; conidia hyaline or brownish, one-celled, small. Hyphomycetous states: *Hormisciella* phragmoconidia arising from hyphal cells as blown-out portions of the lateral wall, brown, elongate, elliptic or fusoid to nearly cylindric, straight or curved, several-septate, the wall thick and dark except at apex and basal scar; *Capnophialophora* or *Hormisciomyces* phialides produced on hyphae, germinating ascospores and/or phragmoconidia, sessile or on 1–2-celled stalks, light brown, ovoid or subglobose, with funnel-shaped collarette; phialides proliferating laterally to form sympodial chains; phialospores rarely seen, minute, hyaline.

Usually superficial on resinous or insect exudates on living leaves or branches of gymnosperms and woody angiosperms.

Numerous genera have been assigned to the Capnodiaceae. The common characters of these genera are the superficial ascocarps developed on or in a thin or well developed hyphal subiculum. Fraser (1935) reported a *Dothidea* type of development for species of *Capnodium*. Martin (1961) and Luttrell (1951b, 1955) considered the family to belong in the Dothideales. Later Luttrell (1965) utilized the ordinal name Capnodiales for members of this family and suggested that other genera with superficial ascocarps also belonged in the order.

Hughes' recent studies (1966, 1967, 1968, pers. comm.) on conidial states of capnodiaceous fungi led to the realization that two series of genera are involved. Not only do conidial states differ, but the hyphae of subiculum and appendages are either cylindric or definitely tapered. These hyphal types are correlated with specific conidial types. Corlett (1970) made a comparative developmental study of two species of capnodiaceous fungi which superficially appeared to be closely related. He described the *Dothidea* type of development for an unidentified species of *Aithalomyces* which had cylindric hyphae. *Metacapnodium juniperi* (Phil. & Plowr.) Speg., with tapered

hyphae, exhibited a *Pleospora* type of development which included the formation of short apical pseudoparaphyses.

The genera and species assigned to the Capnodiaceae must be thoroughly investigated so that the limits of the family may be drawn. At this time, I can put forth only a tentative outline of those genera from temperate North America which do appear to have a *Dothidea* type of development and are grouped in the family Capnodiaceae sens. str. The other series of genera must be transferred to the Pleosporales, as a family related to the Chaetothyriaceae and Dimeriaceae. Temperate North American representatives of *Limacinia* sens. str. and *Ophiocapnocoma* have tapering hyphae and appendages, *Capnocybe* or *Hormiokrypsis* conidia, and exhibit a *Pleospora* type of development. These genera are excluded from my concept of Capnodiaceae.

Key to Genera

1. Ascocarps depressed globose, yellowish or orange, not appendaged, on a thin subiculum; ascospores one-septate. *Rhytidenglerula.*
1. Ascocarps globose depressed or vertically elongated, dark brown to black, appendaged or not; ascospores several-septate.
   2. Ascocarps vertically elongated, the base sterile, not appendaged; conidia borne in flask-shaped pycnidia accompanying ascocarps. *Scorias.*
   2. Ascocarps globose or depressed, appendaged; conidia arising from hyphae and/or phialides.
      3. Ascospores transversely septate; phialidic conidial state *Hormisciomyces.* *Aithalomyces.*
      3. Ascospores both transversely and vertically septate; phialidic conidial state *Capnophialophora.* *Strigopodia.*

Phaeocapnias Cif. & Bat., which according to Hughes (1968) has cylindric hyphae and produces *Hormisciella* conidia and *Hormisciomyces* phialides, probably belongs in this family. The ascospores are transversely septate and mucronate at the ends.

Rhytidenglerula v.Höhnel, Sitzungsber. Kaiserl. Akad. Wiss. Math.-Naturwiss Kl. Abt. 1, 127: 386. 1918.

Subiculum thin, brown, of septate, cylindric, hyphopodiate hyphae; ascocarps seated on the subiculum, bright yellowish orange, depressed globose with plane apex; wall thin, of one layer of cells, gelatinizing above, the basal wall brown. Asci subglobose. Ascospores hyaline becoming brown (the pigment mostly encrusted on the wall), elliptic to obovate, 1-septate, constricted at the septum; wall roughened.

Conidial state: *Capnodiastrum* Speg.: Pycnidia similar to ascocarps; conidia brown, one-celled.

Type species: *R. carnea* (Ell. & Mart.) v.Höhnel.

Rhytidenglerula carnea (Ell. & Mart.) v.Höhnel, Sitzungsber. Kaiserl. Akad. Wiss. Math.-Naturwiss. Kl. Abt. 1, 127: 386. 1918. Figures 157–158.

For synonymy see Müller and von Arx (1962).

Ascocarps 70–80 μ diam, about 50 μ high. Asci 30–34 × 22–26 μ. Ascospores 16–21 × 8–10 μ, obovate; upper cell broader than lower.

On living leaves of *Persea borbonia* (L.) Spreng., southeastern North America.

Material examined:

Florida: *Ellis N.A.F. 1290.*

This genus has been placed in the family Englerulaceae, which is characterized by thin walled, gelatinizing ascocarps. Although *Rhytidenglerula* differs from the other genera of the Capnodiaceae in its brightly colored ascocarps and sparse subiculum, the structure of the locule appears to be dothideaceous, and the genus is tentatively transferred to the Capnodiaceae.

Scorias Fr. Syst. Orb. Veget. 1: 171. 1825; Syst. Mycol. 3: 291. 1832.

Subiculum massive, black, forming irregular points, composed of interwoven cylindric brown hyphae adhering together in gelatinous matrix; ascocarps vertically elongated (the base sterile), grouped and arising from the subiculum; wall glabrous, thin; apex rounded. Asci oblong to saccate. Ascospores hyaline, olivaceous brown at maturity, clavate, several-septate; wall smooth or roughened.

Conidial state: Pycnidia flask-shaped, intermixed with ascocarps; conidia minute, brown, one-celled.

Type species: *S. spongiosa* Schw. ex Fr.

Scorias spongiosa Schw. ex Fr. Syst. Mycol. 3: 291. 1832. Figures 159–161.

Ascocarps 50–84 μ diam, 60–140 μ high, the sterile base 60–200 μ long; wall ca. 12 μ thick, pallid at apex. Asci 38.5–50 × 10–13 μ. Ascospores 13–15 × 3.5–4.5 μ, hyaline, soon olivaceous brown, clavate, 3-septate, not constricted at the septa or slightly constricted at the primary septum; wall finely roughened at maturity.

Pycnidia 30–50 μ diam, 100–150 μ high, tapering to an elongate apex 12–18 μ diam, up to 200 μ long; conidia minute.

On leaves and branches of *Fagus* spp., Europe, North America.

Material examined:

New York: New York, Feb 1917, *Codding* (MASS); Ohio: *Cooke 37593, 38203* (MASS); Pennsylvania: *Ellis N.A.F. 1363, 1363b;* North Carolina: Greensborough, 1957, *Schuster* (MASS).

In *Scorias spongiosa* the massive subiculum may reach several cm in diameter and is composed of cylindric brown hyphae, each surrounded by a gelatinous coating. Over the surface of the sterile mycelium ascocarps and pycnidia are produced. Both are glabrous and have a short to elongate sterile base. Ascocarps are globose ovate whereas pycnidia are narrowly ovate or flask shaped. The hyphal structure, especially the gelatinous coating over hyphae and fruiting structures, is somewhat reminiscent of that in *Atichia* in the Myriangiales.

Aithalomyces Woronichin, Ann. Mycol. 24: 148. 1926.

Subiculum blackish brown, composed of cylindric, dark brown, branched and anastomosed hyphae; cells short, somewhat constricted at septa, thick walled, often roughened with encrusted brown pigment; ascocarps globose or depressed, seated in the subiculum; wall thin, clothed with septate, cylindric, hyphal appendages which are usually lax and trailing. Asci saccate oblong, aparaphysate. Ascospores brown, obovate or elliptic, several-septate, often constricted at the septa, crowded in the ascus.

Conidial states: *Hormisciella* phragmoconidia, *Hormisciomyces* phialides.

Woronichin (1926) described *Aithalomyces* with two species, *A. arctica* and *A. rhododendri.* Although he did not specifically designate either as type species of the genus, his emphasis in the article was on *A. arctica.* He discussed this species in some detail and compared it with *Limacinia* (?) *alaskensis* Sacc. & Scalia which he concluded was probably also a species of *Aithalomyces.* A translation of a pertinent paragraph reads:

> All these considerations cause me to separate the described fungus (i.e. *A. arctica*) as representative of a separate genus (*Aithalomyces*) to which probably *Limacinia* (?) *alaskensis* Sacc. & Scal. must be transferred.

Woronichin went on to discuss a second species which he described as *A. rhododendri.* Thus Woronichin effectively designated *Aithalomyces arctica* Wor. as type of the generic name. Batista and Ciferri (1963) were incorrect in designating *A. rhododendri* Wor. as the generic type.

Lectotype: *A. arctica* Wor.

Aithalomyces arctica Wor. Ann. Mycol. 24: 149. 1926.

≡ *Limacinia arctica* (Wor.) Barr, Canad. J. Bot. 39:310. 1961.

For description and illustration of ascospores see Barr (1961).

Woronichin (1926) described *Clasterosporium*-like conidia which were associated with the hyphae of *A. arctica.* These were elongate elliptic, curved at the ends, 53–63 × 10 μ, 7- to 9-septate, brown, with a circular basal scar. He suggested that they developed directly from the hyphae as do the *Clasterosporium* conidia of *Hormiscium pinophilum* (Nees ex Pers.) Lindau. From his description, the conidia would seem to be referable to *Hormisciella.*

Additional species:

Aithalomyces alaskensis (Sacc. & Scalia) Barr, comb. nov. Figures 165–167.

≡ *Limacinia* (?) *alaskensis* Sacc. & Scalia, Harriman Alaska Expedition 5: 34. 1904.
≡ *Morfea alaskensis* (Sacc. & Scalia) Bat. & Cif. Saccardoa 2: 142. 1963.

For description and illustrations see Barr (1955).

Phragmoconidia and phialides were described for this species (Barr 1955). *Morphea* Roze (as '*Morfea* Roz' in Batista and Ciferri 1963) was apparently based on conidial structures, and neither asci nor ascospores were described. Saccardo, in Sylloge Fungorum 22: 63, considered the species of *Morphea* as potential conidial states of *Limacinia* or of *Capnodium.* No evidence has been presented that *Morphea* is an ascomycete.

Following the suggestions of Woronichin (1926), Corlett (1970), and Hughes (pers. comm.), I am transferring *Limacinia* (?) *alaskensis* to *Aithalomyces.* Other species of *Limacinia,* e.g. *L. moniliformia* (Fraser) Barr, *L. quinquesepta* (Barr) Hughes, and *L. multiseptata* Barr [= *Ophiocapnocoma phloiophilia* (Fisher) Hughes], all possess tapered hyphae and ascocarp appendages as well as different conidial states. My re-examination of slides of these three species showed that short apical pseudoparaphyses were present, and a *Pleospora* type of development is inferred.

Strigopodia Batista in Bat., Maia & Vital, Anales Soc. Biol. Pernambuco 15: 440. 1957.

Subiculum massive, on resinous exudate on conifer bark; hyphae brown, cylindric; ascocarps seated in the subiculum, globose; hyphal appendages cylindric, occasionally sparse or lacking; wall of polygonal brown cells, thin. Asci oblong or saccate. Ascospores hyaline at first, soon yellow brown or dark brown, elliptic, several-septate; vertical septum present in one or several of mid cells; wall lighter brown toward both ends, smooth.

Conidial states: *Hormisciella* phragmospores, *Capnophialophora* phialides.

On resinous exudates on branches of gymnosperms, North America, Europe.

Type species: *S. resinae* (Sacc. & Bres.) Hughes.

Strigopodia resinae (Sacc. & Bres.) Hughes, Canad. J. Bot. 46: 1100. 1968. Figures 162–164.

Hughes (1968) described, discussed and illustrated details of this species and of *S. batistae. S. resinae* is known from Europe and eastern North America. An additional collection which is referable to this species is that designated as *Chaetosphaeria resinicola* n.sp. *Peck,* ined., Jayville, New York, June (NYS). The specimen agrees with Hughes' description except for the somewhat smaller sizes of its asci and ascospores.

Additional species:

Strigopodia batistae Hughes, Canad. J. Bot. 46: 1104. 1968.

On *Larix* and *Pseudotsuga,* western North America.

For description and illustrations see Hughes (1968).

Strigopodia spongiosa (Barr) Barr, comb. nov.

≡ *Capnodium spongiosum* Barr, Canad. J. Bot. 33: 511. 1955.
≡ *Capnophaeum spongiosum* (Barr) Bat. & Cif. Saccardoa 2: 108. 1963.

For description and illustrations (excluding figures 35 and 39) see Barr (1955). The specimens cited should be revised to exclude the collection from Washington (*W. B. Cooke 19660*) which is *S. batistae* Hughes. Also, it is obvious that at least two different fungi are associated in the massive subicula of the California collections. *Capnocybe spongiosa* (Hoerl) Hughes with tapered hyphae and sympodioconidia (cf. Hughes, 1966 and Barr, 1955, figs. 35, 39) forms a large portion of the subicula in the California material. Slides made during my earlier study of these collections bear both tapered and cylindric hyphal components. The ascocarps of *Strigopodia spongiosa* are borne on cylindric hyphae and their appendages are cylindric also.

There does not appear to be any difficulty in transferring the present species to *Strigopodia.* Phragmoconidia referable to *Hormisciella* and *Capnophialophora* phialides are both formed on cylindric hyphae (my 1955 "subiculoid hyphae of the second type"); ascocarps, asci, and ascospores are all typical of *Strigopodia.* The ascospores are septate in the same manner as those of *S. resinae,* with median primary septum, whereas those of *S. batistae* have submedian primary septum. Ascospores of *S. spongiosa* are narrower than those of the other two species.

I cannot accept Batista and Ciferri's transfer of this species to *Capnophaeum.* The type species of the latter genus, *C. indicum* (Bern.) Speg., was described as having closely associated elongate pycnidia containing small hyaline conidia. *Capnophaeum* should be restricted to species with similar pycnidial association. The genus would appear to be more closely related to *Scorias* than to *Strigopodia.*

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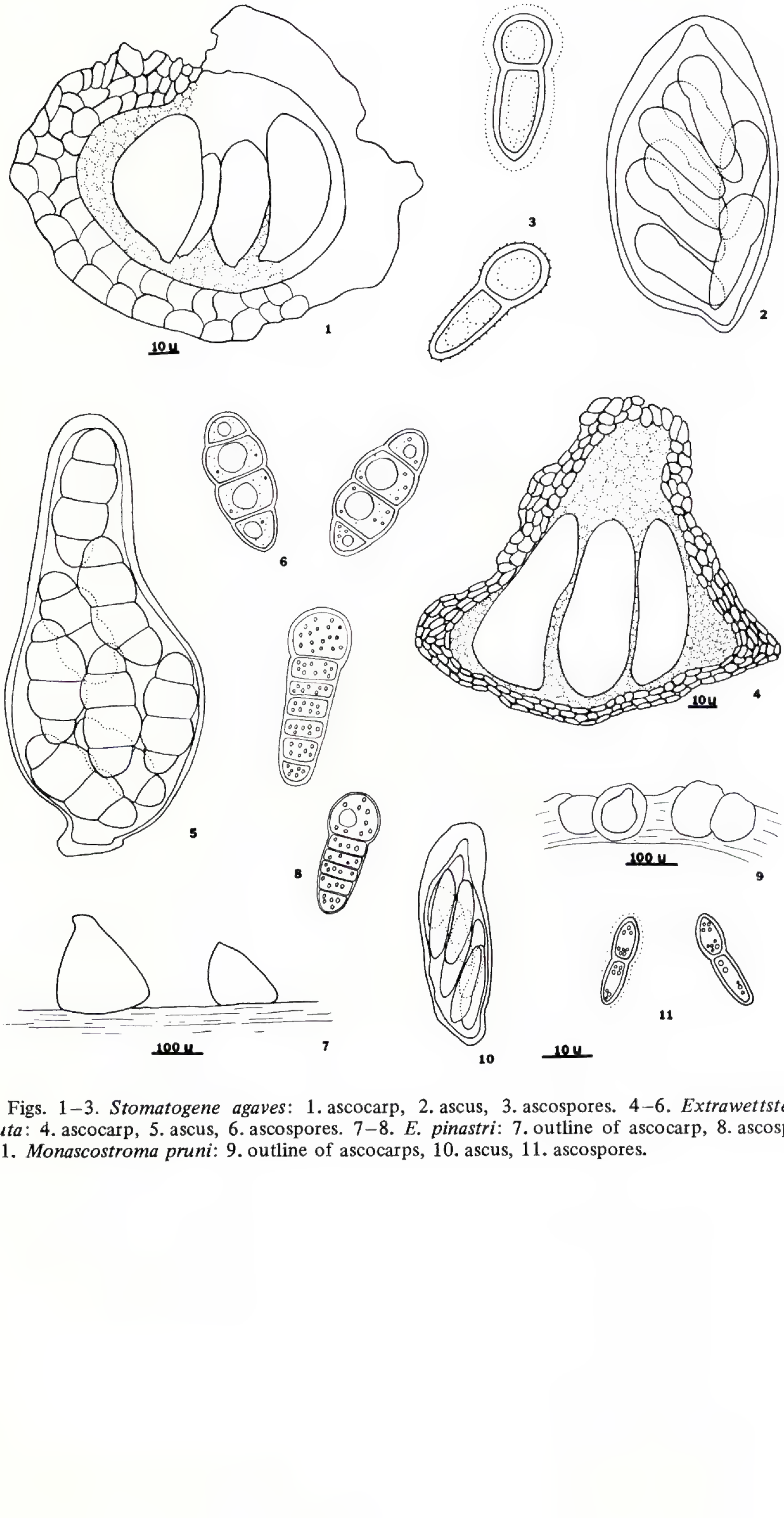
Addendum

Melanodothis R. H. Arnold, Canad. J. Bot. 49: 2188. 1972 ["1971"].

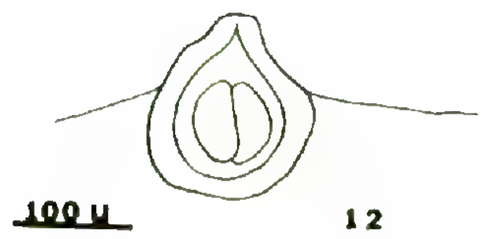
Type species: *Melanodothis caricis* R. H. Arnold.

The genus belongs in the Dothideaceae, as established by Arnold (*Melanodothis caricis,* n. gen., n. sp. and *'Hyalodothis ? caricis.'* Canad. J. Bot. 49: 2187–2196.) with her account of structure and development, and the excellent illustrations. *Ramularia*-like conidia were formed in culture, as in some species of *Mycosphaerella.* The aspect of stromata is quite like that of *Rhizogene,* but shape, septation, and pigmentation of the ascospores differ between the two genera. This genus could be keyed out in the Dothideaceae next to *Discosphaerina,* which also has one-celled hyaline ascospores, and the two separated as follows:

1. Ascocarps uniloculate or few together. *Discosphaerina.*
1. Ascocarps multiloculate, produced from and over hypostromatic tissues. *Melanodothis.*



Figs. 1–3. *Stomatogene agaves*: 1. ascocarp, 2. ascus, 3. ascospores. 4–6. *Extrawettsteinina minuta*: 4. ascocarp, 5. ascus, 6. ascospores. 7–8. *E. pinastri*: 7. outline of ascocarp, 8. ascospores. 9–11. *Monascostroma pruni*: 9. outline of ascocarps, 10. ascus, 11. ascospores.



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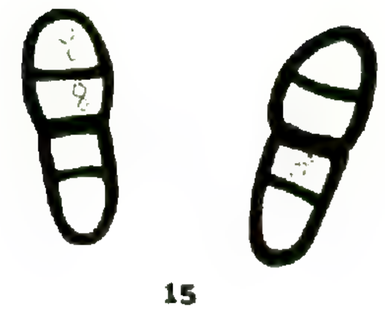

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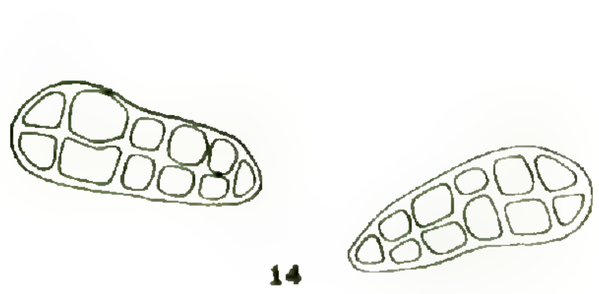

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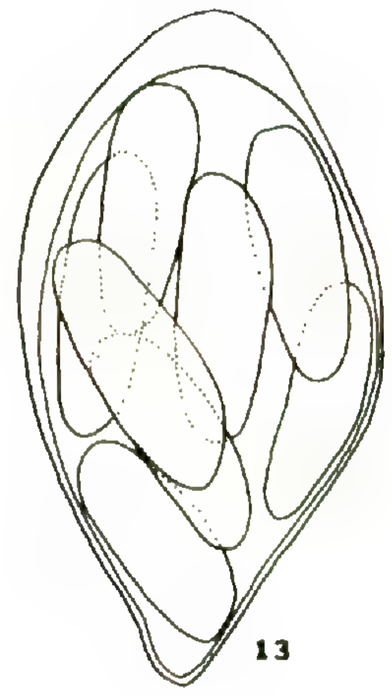

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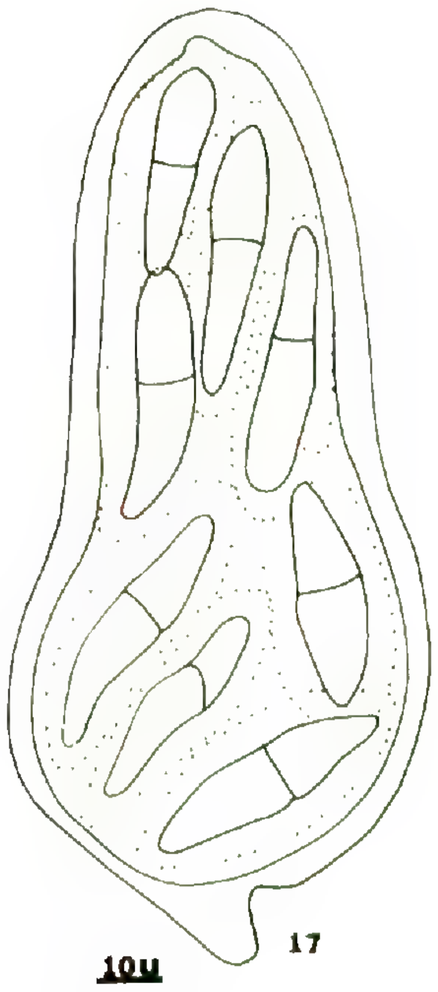

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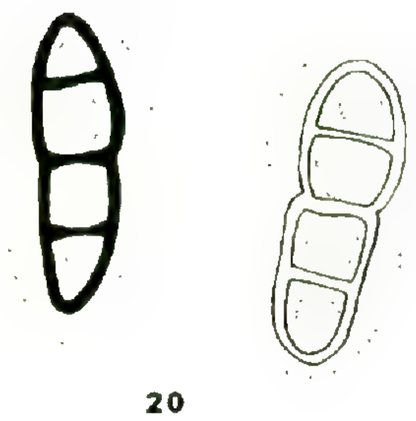

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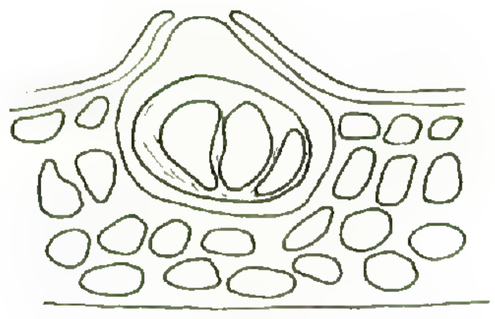

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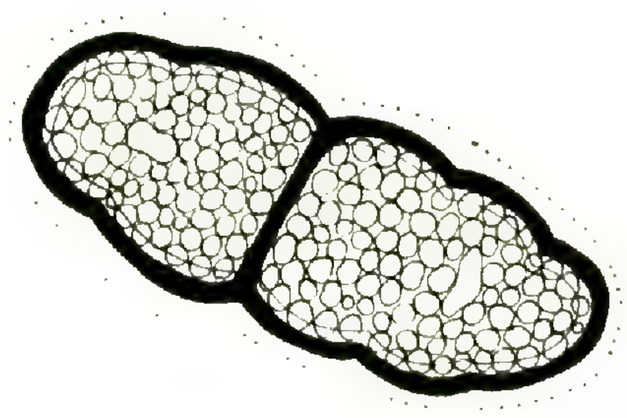

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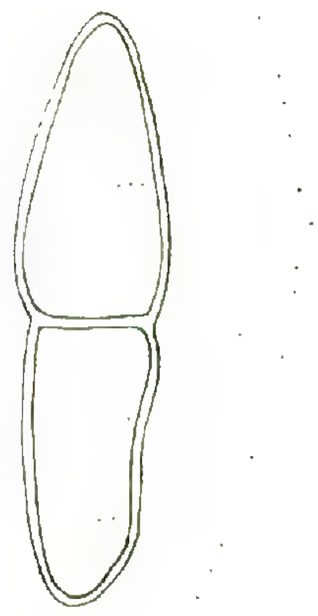

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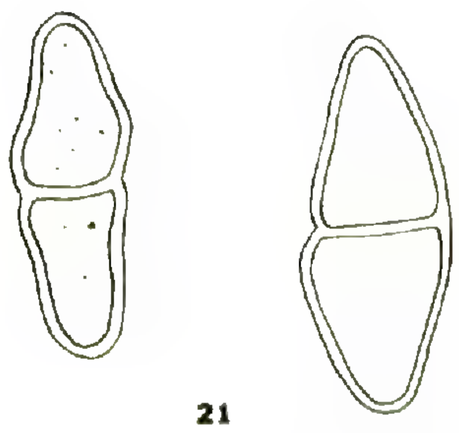

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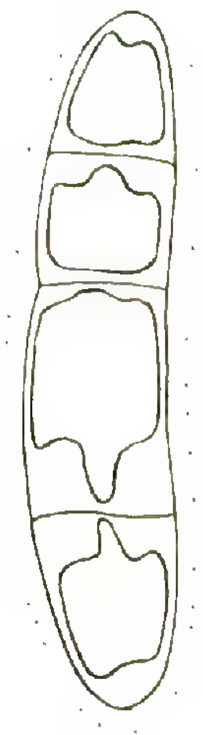

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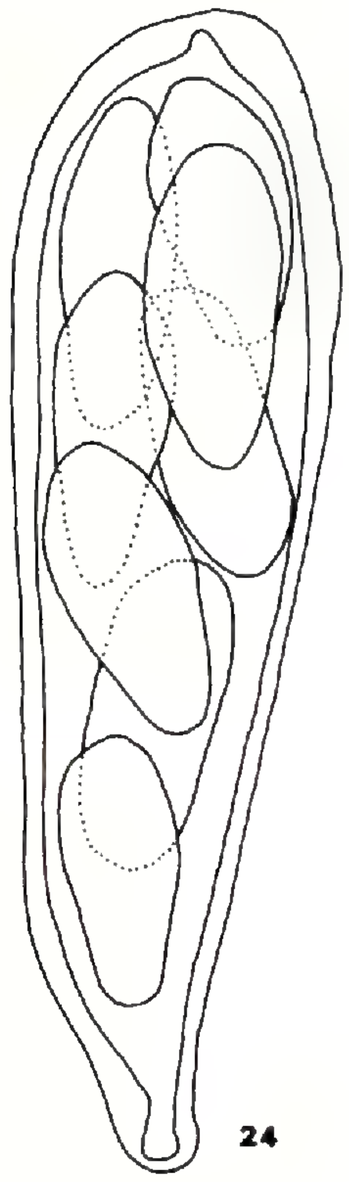
Figs. 12–14. *Leptosphaerulina pulchra*: 12. outline of ascocarp, 13. ascus, 14. ascospores. 15. *L. hyperborea*: ascospores. 16–18. *Wettsteinina mirabilis*: 16. outline of ascocarp, 17. ascus, 18. ascospore. 19. *W. gigaspora*: ascospore. 20. *W. ellisii*: ascospores. 21. *W. anomala*: ascospores. 22. *W. macrotheca*: ascospore.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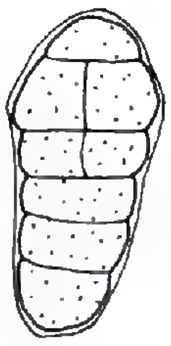
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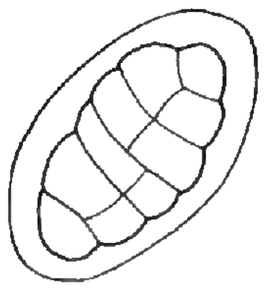

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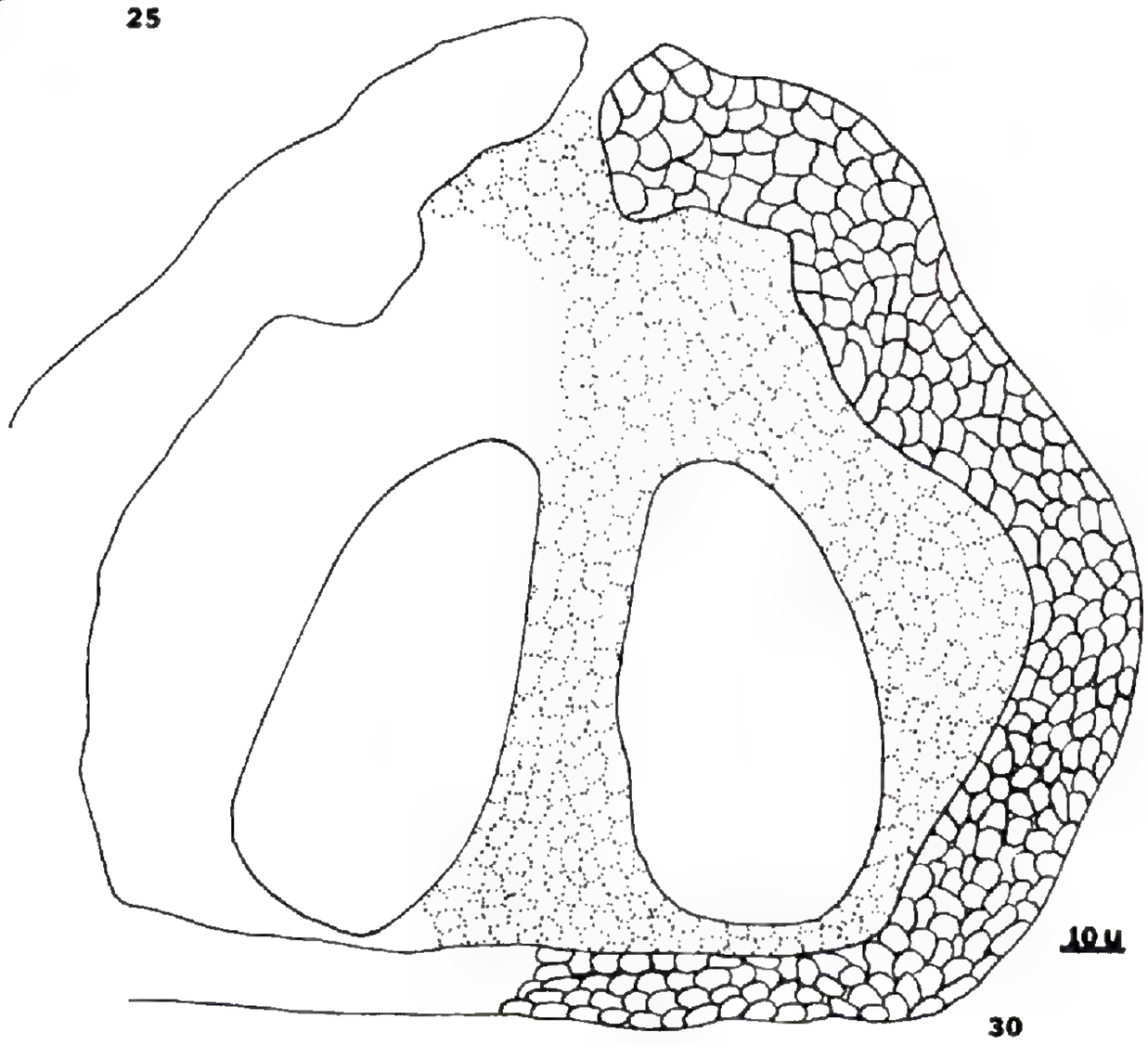
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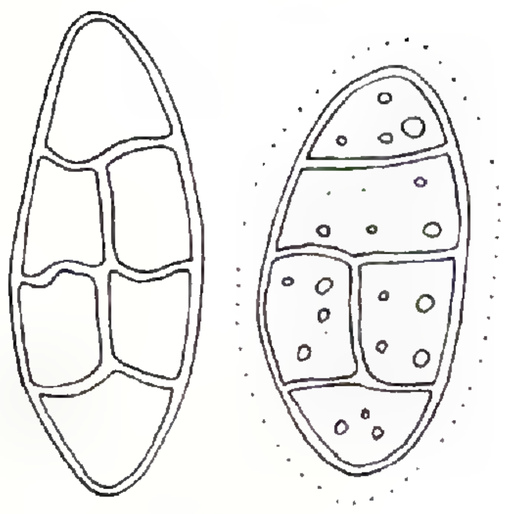
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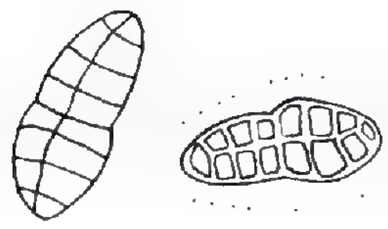
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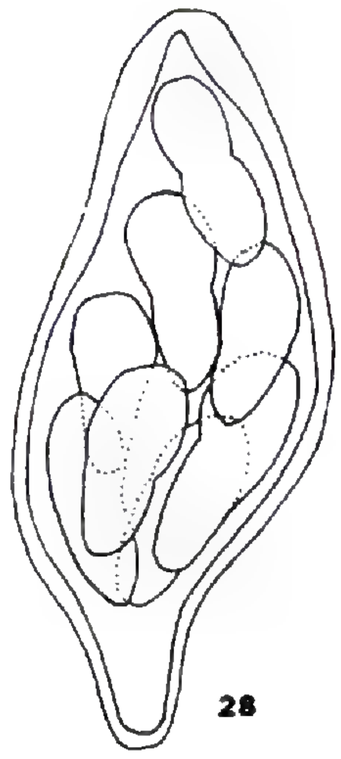
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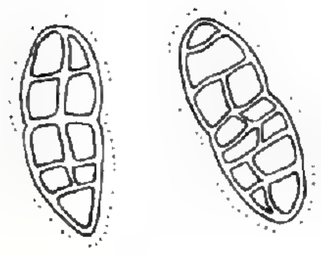
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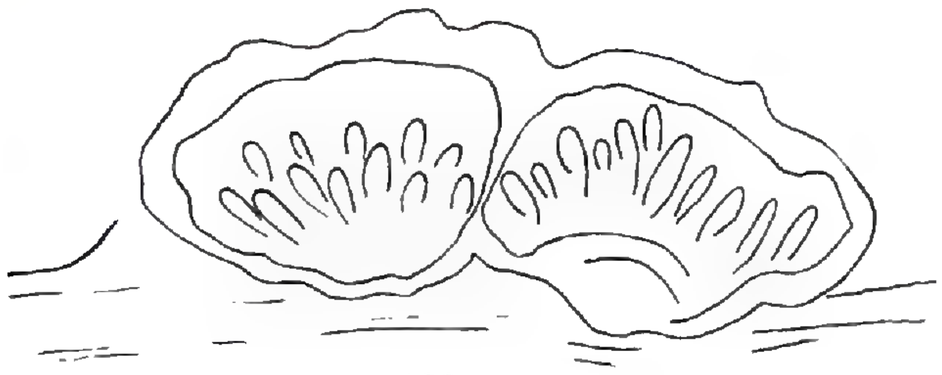
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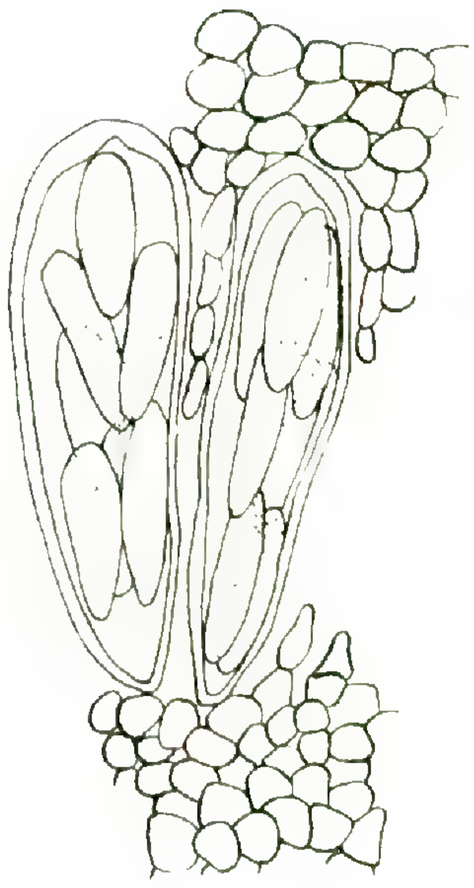
Figs. 23–25. *Pyrenophora scirpi*: 23. outline of ascocarp, 24. ascus, 25. ascospores. 26. *P. schroeteri*: ascospores. 27–29. *Dermatina elabens*: 27. outline of ascocarp, 28. ascus, 29. ascospores. 30–31. *D. pyrenocarpa*: 30. ascocarp, 31. ascospores.



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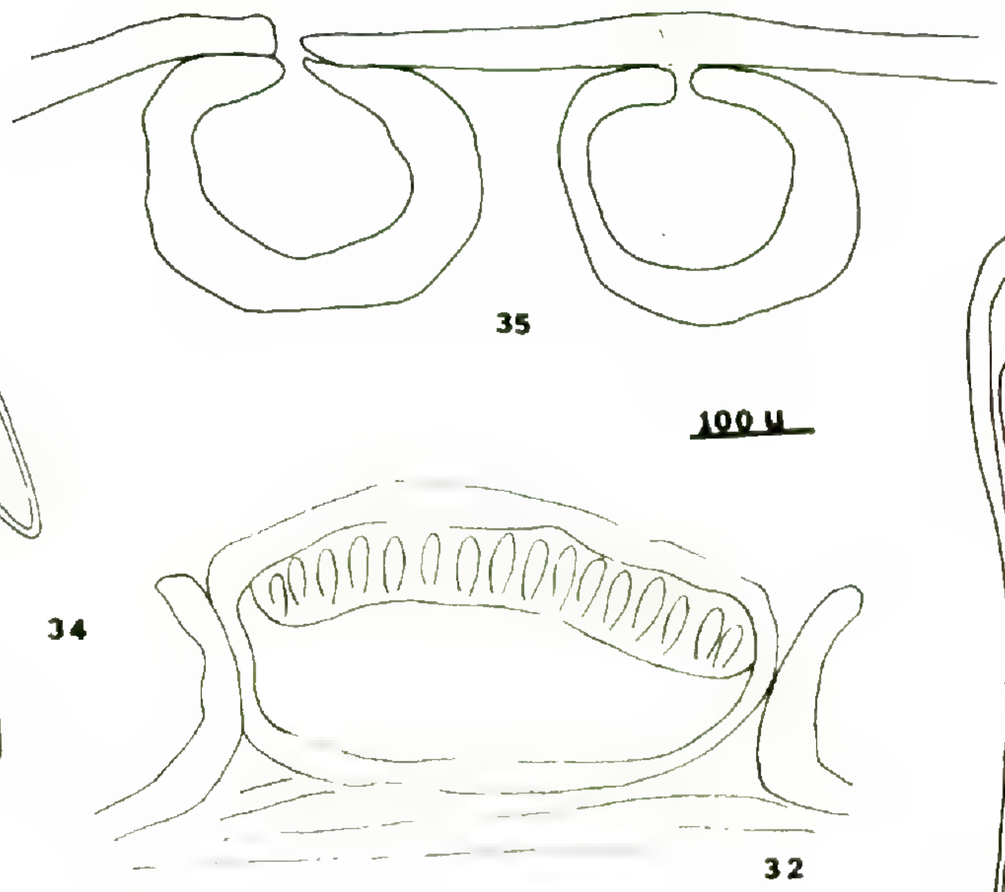

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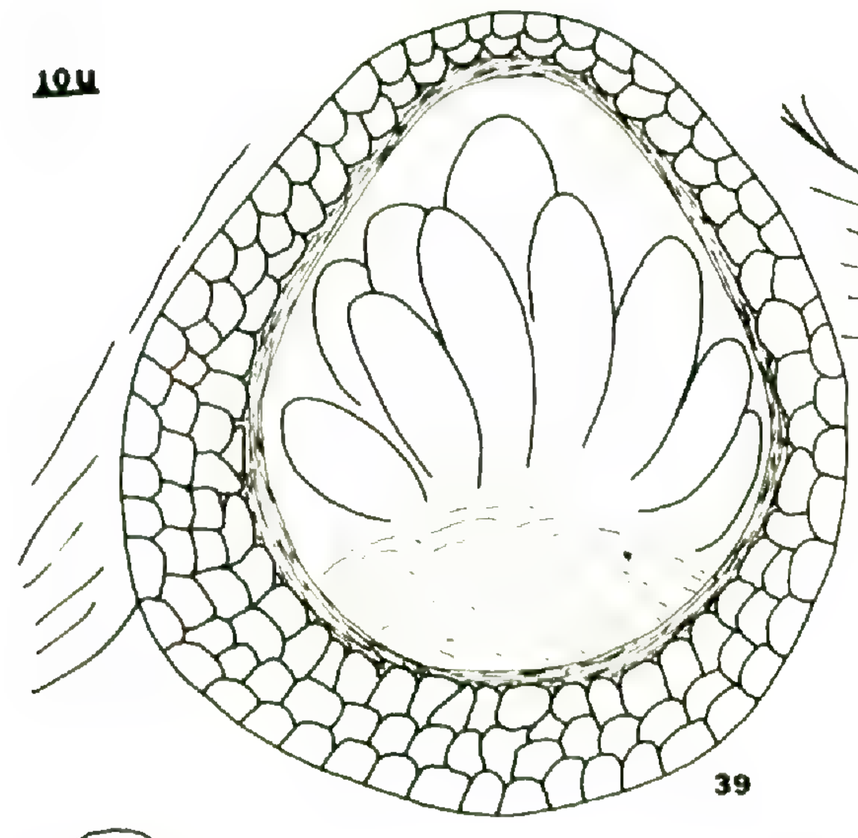

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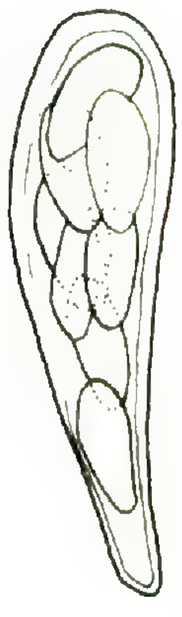

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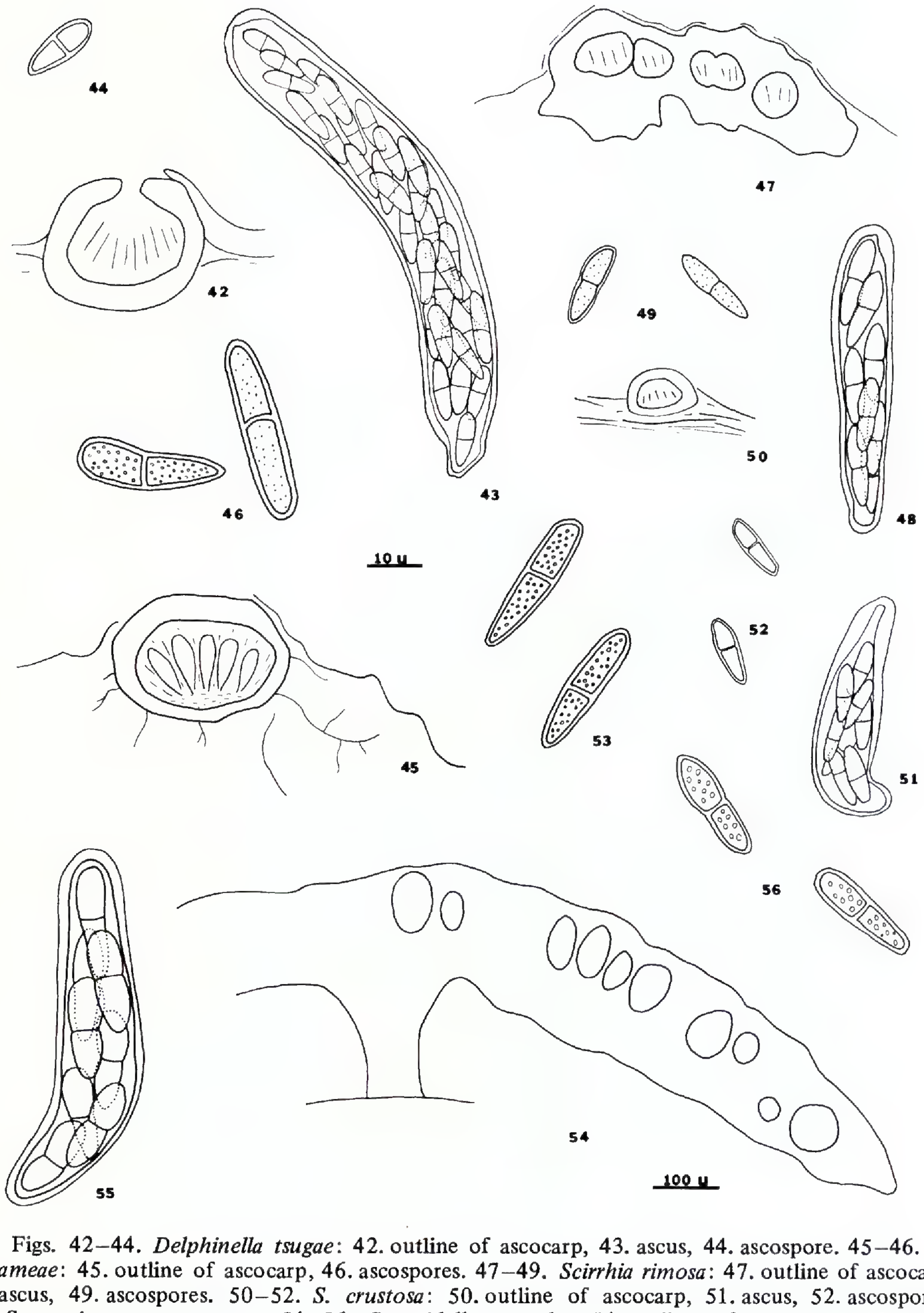
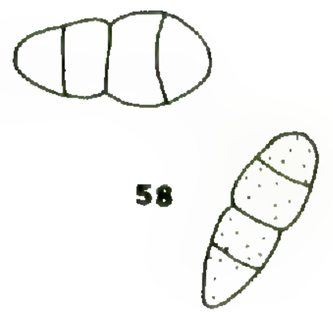
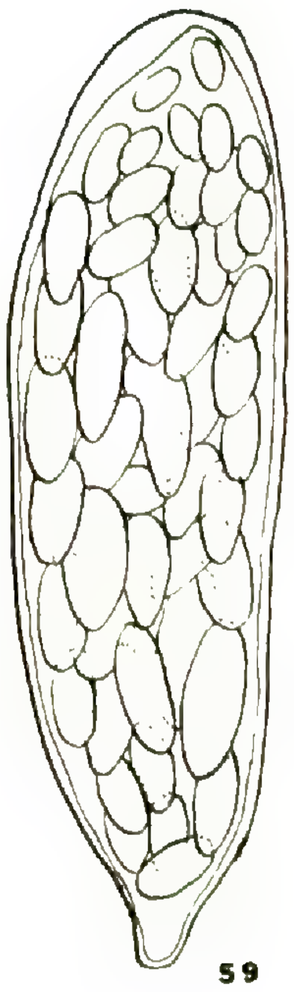
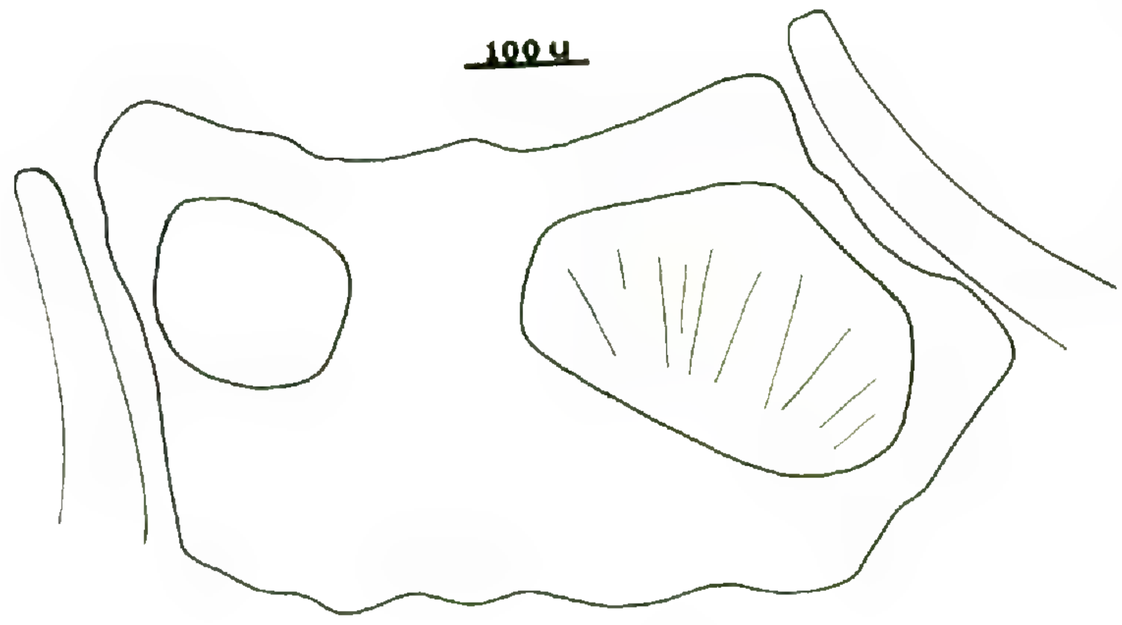
Figs. 32–34. *Bagnisiella australis*: 32. outline of ascocarp, 33. asci in locule, 34. ascospores. 35–37. *Botryosphaeria dothidea*: 35. outline of ascocarp, 36. ascus, 37. ascospores. 38. *B. quercuum*: outline of ascocarp. 39–41. *B. bidwellii*: 39. ascocarp, 40. ascus, 41. ascospores.

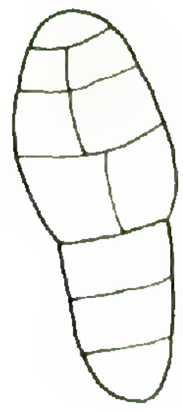


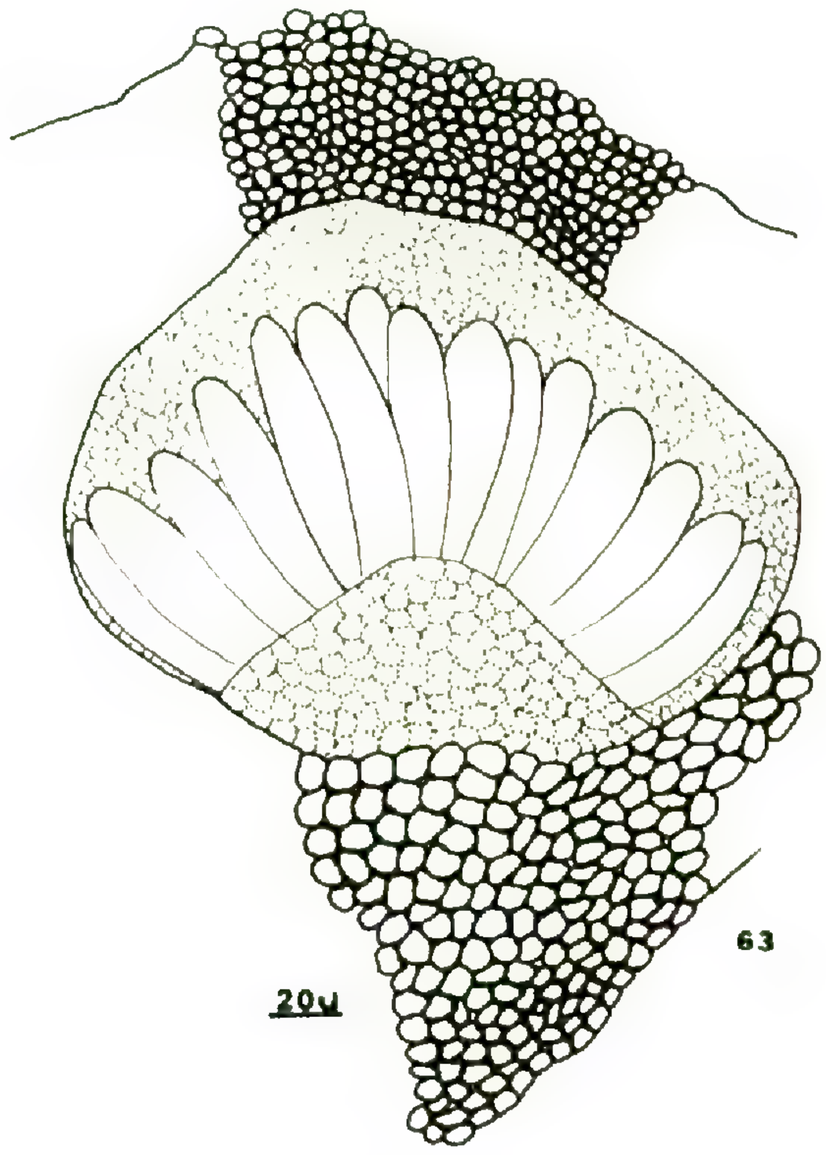
Figs. 42–44. *Delphinella tsugae*: 42. outline of ascocarp, 43. ascus, 44. ascospore. 45–46. *D. balsameae*: 45. outline of ascocarp, 46. ascospores. 47–49. *Scirrhia rimosa*: 47. outline of ascocarp, 48. ascus, 49. ascospores. 50–52. *S. crustosa*: 50. outline of ascocarp, 51. ascus, 52. ascospores. 53. *S. conigena*: ascospores. 54–56. *Coccoidella scutula*: 54. outline of ascocarp, 55. ascus, 56. ascospores.

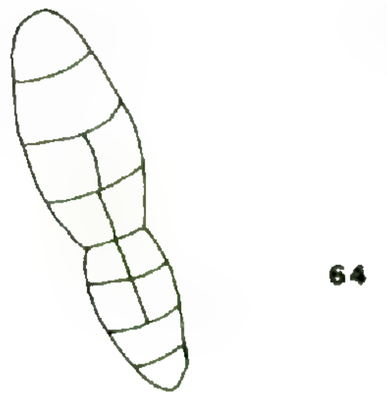


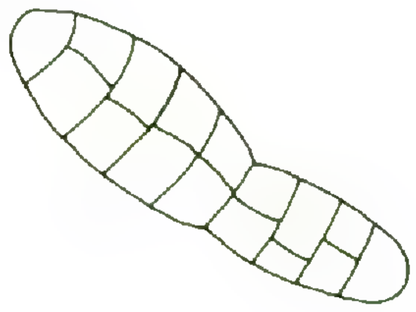




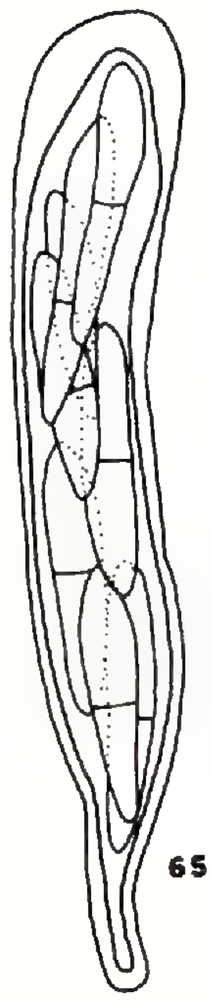








Figs. 57–58. *Sydowia polyspora*: 57. outline of ascocarp, 58. ascospores. 59–60. *S. versiformis*: 59. ascus, 60. ascospores. 61. *S. pruni*: ascospores. 62–64. *Dothiora pyrenophora*: 62. outline of ascocarp, 63. asci in locule, 64. ascospores.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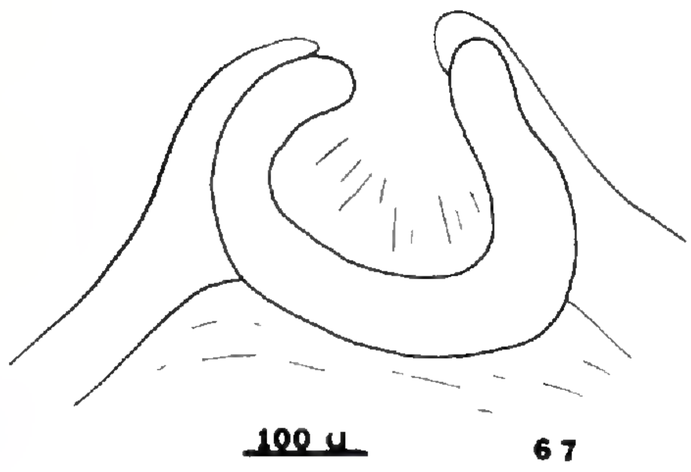
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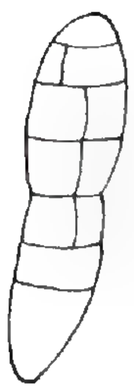

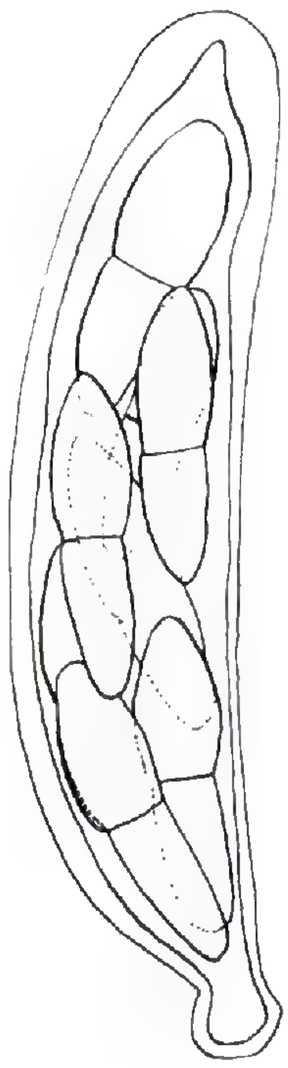
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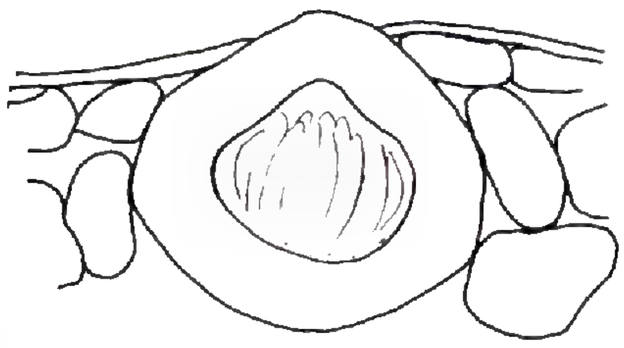
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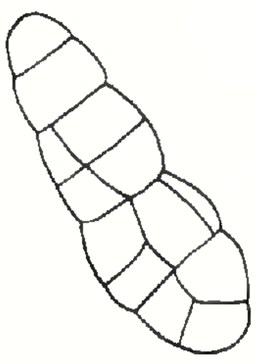

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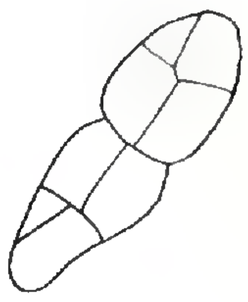

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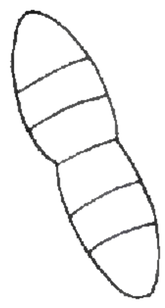

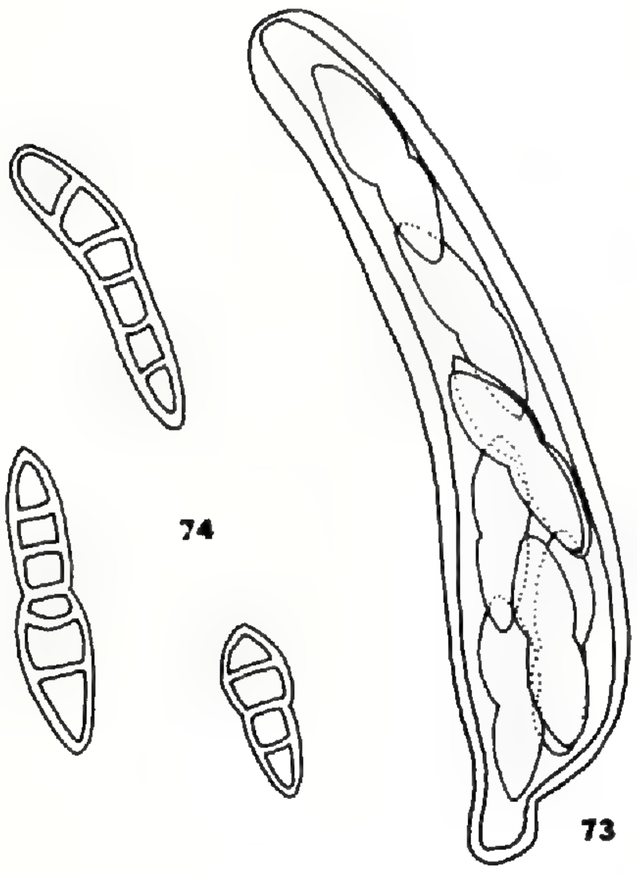
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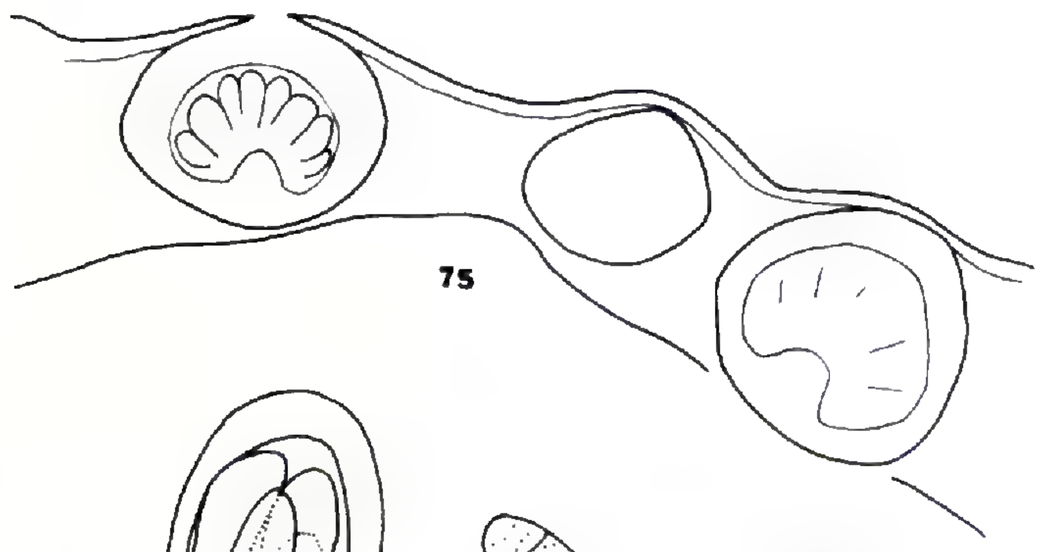
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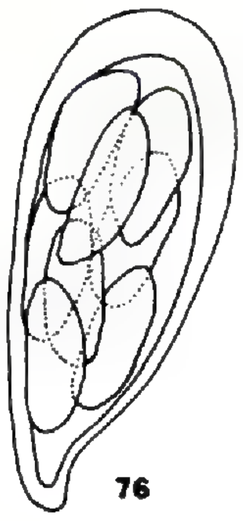
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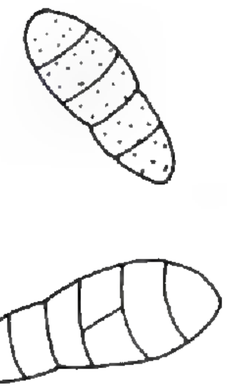

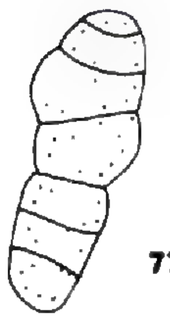
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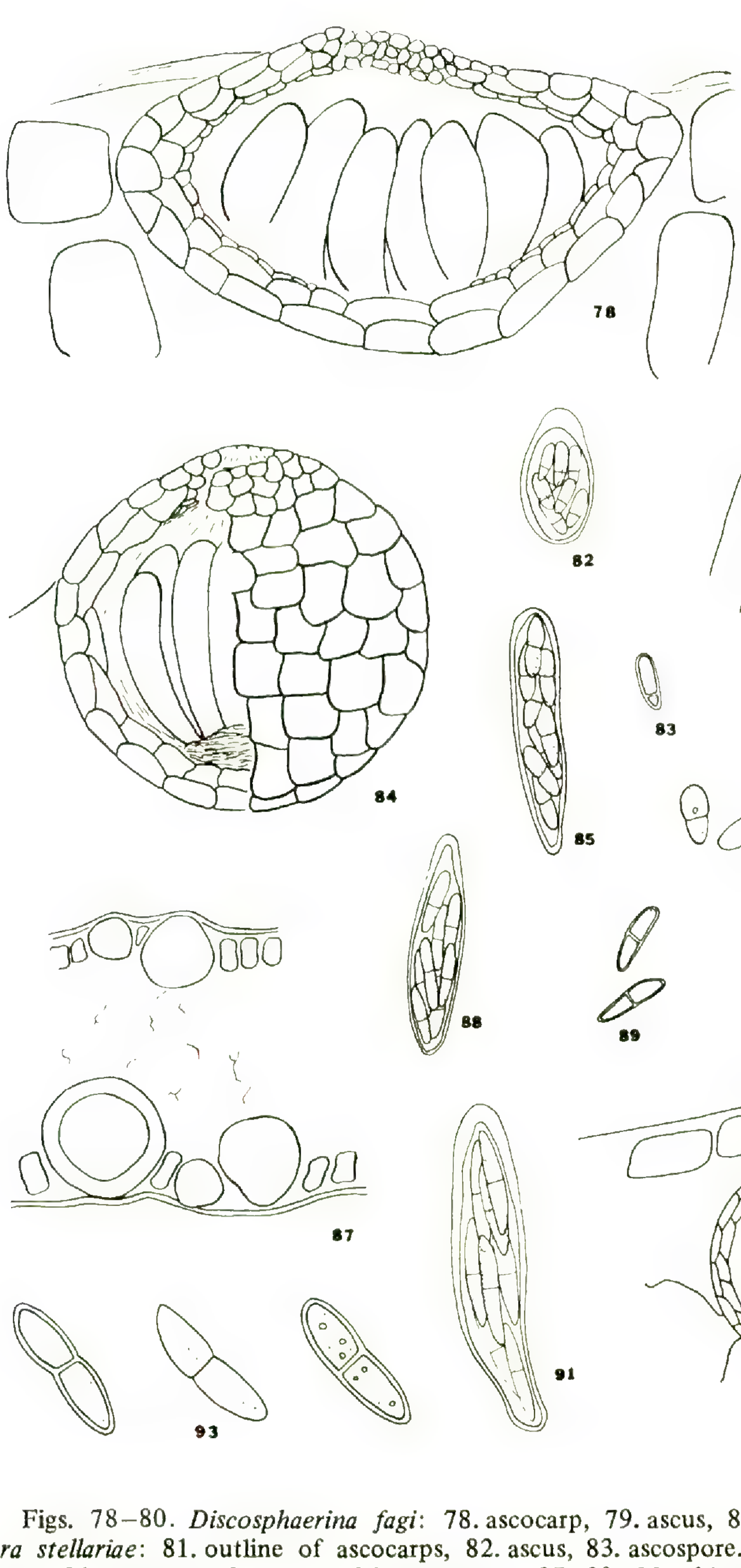
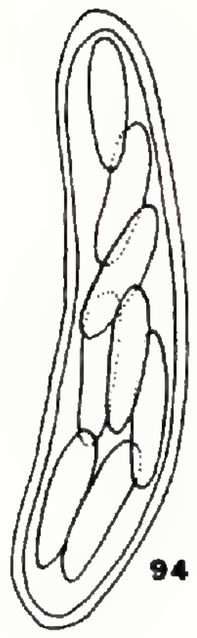
Figs. 65–66. *Dothiora ribesia*: 65. ascus, 66. ascospores. 67–69. *D. sambucina*: 67. outline of ascocarp, 68. ascus, 69. ascospores. 70–71. *D. taxicola*: 70. outline of ascocarp, 71. ascospores. 72. *D. thujae*: ascospores. 73–74. *D. wolfii*: 73. ascus, 74. ascospores. 75–77. *Saccothecium sepincola*: 75. outline of ascocarp, 76. ascus, 77. ascospores.



Figs. 78–80. *Discosphaerina fagi*: 78. ascocarp, 79. ascus, 80. ascospores. 81–83. *Omphalospora stellariae*: 81. outline of ascocarps, 82. ascus, 83. ascospore. 84–86. *Mycosphaerella punctiformis*: 84. ascocarp, 85. ascus, 86. ascospores. 87–89. *M. chimaphilae*: 87. outline of ascocarps, 88. ascus, 89. ascospores. 90–92. *M. coptis*: 90. ascocarp, 91. ascus, 92. ascospores. 93. *M. janus*: ascospores.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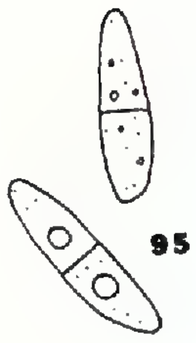
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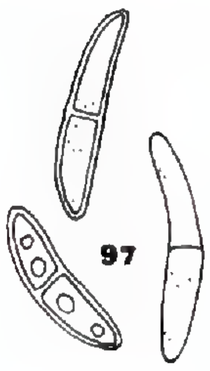
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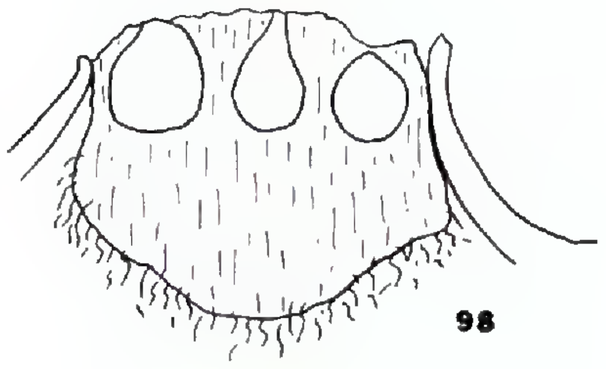
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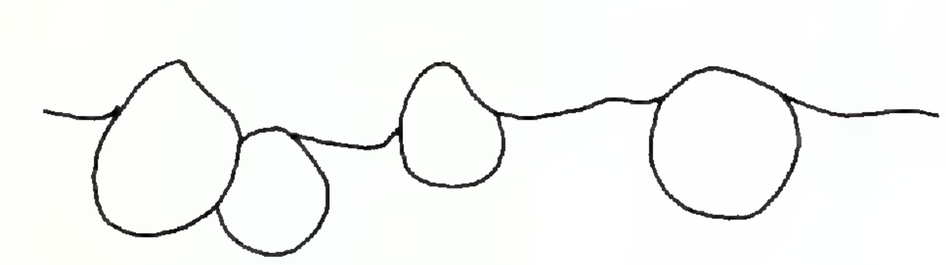
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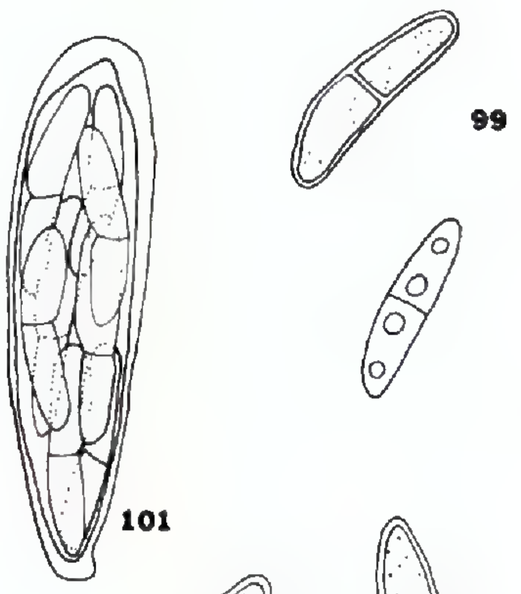
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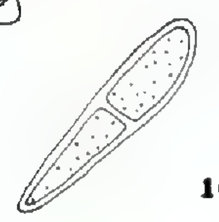
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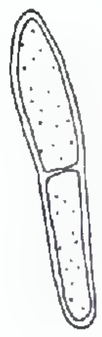

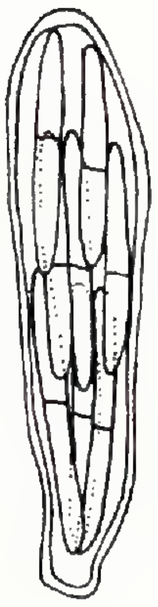
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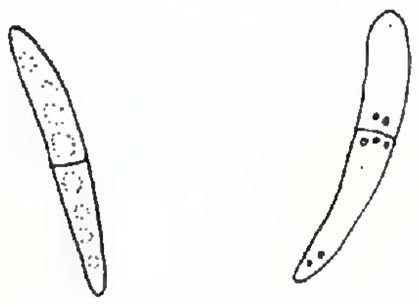

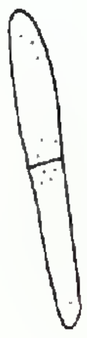
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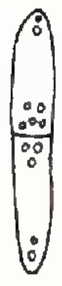

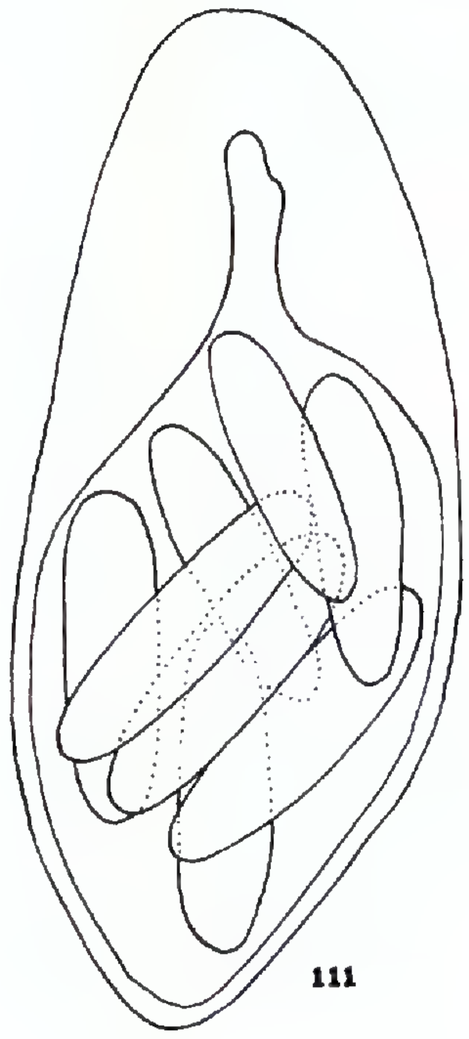
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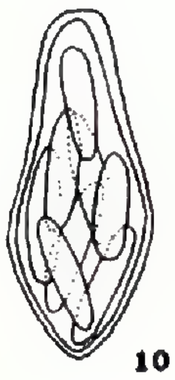
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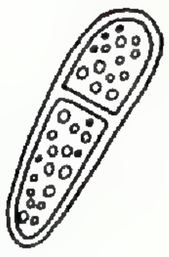

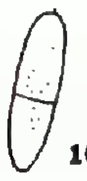
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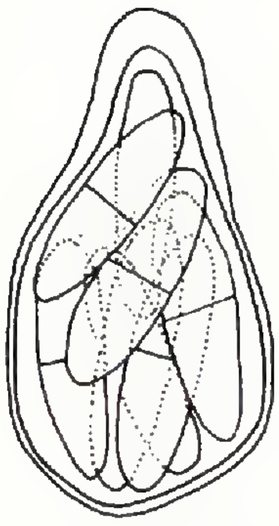
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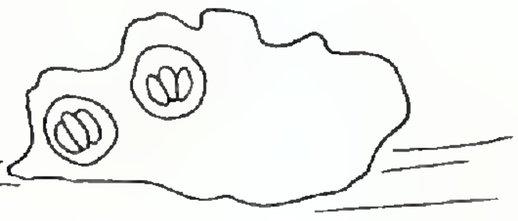
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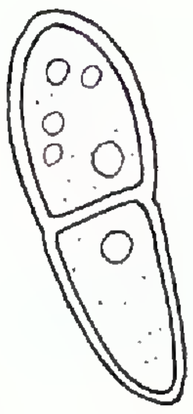
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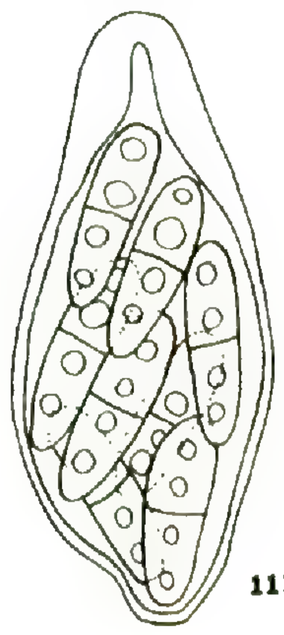
Figs. 94–95. *Mycosphaerella dearnessii*: 94. ascus, 95. ascospores. 96–97. *M. populorum*: 96. ascus, 97. ascospores. 98–99. *M. acervata*: 98. outline of ascocarp, 99. ascospores. 100–102. *M. ranunculi*: 100. outline of ascocarps, 101. ascus, 102. ascospores. 103–104. *M. linnaeae*: 103. ascus, 104. ascospores. 105. *M. alnicola*: ascospores. 106–107. *M. iridis*: 106. ascus, 107. ascospores. 108–109. *M. polifoliae*: 108. ascus, 109. ascospores. 110–112. *M. killianii*: 110. outline of ascocarp, 111. ascus, 112. ascospores.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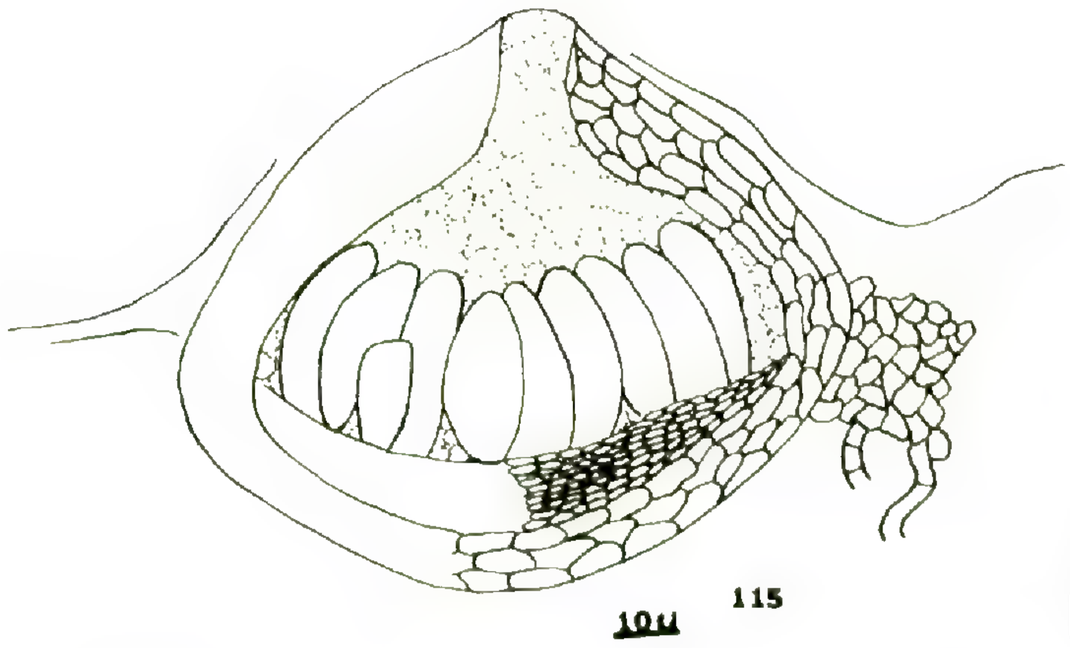
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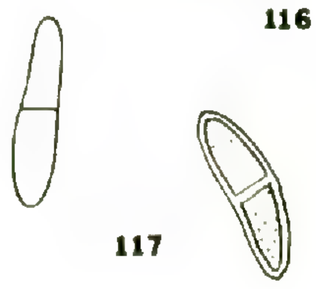
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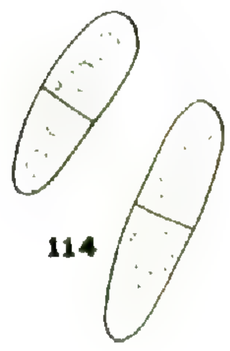
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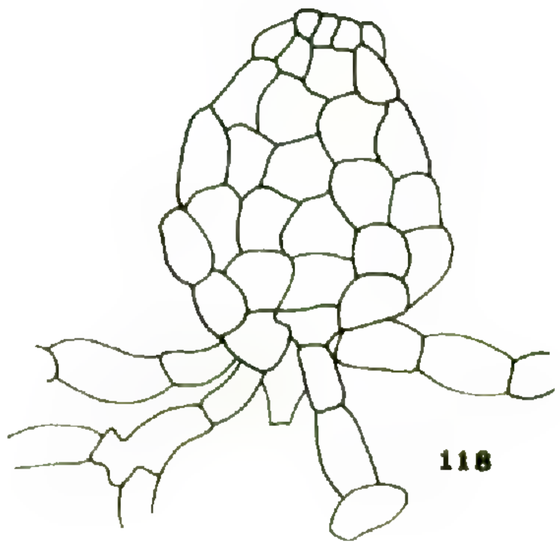
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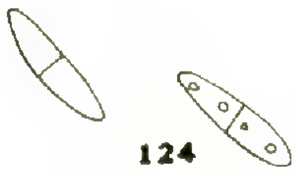
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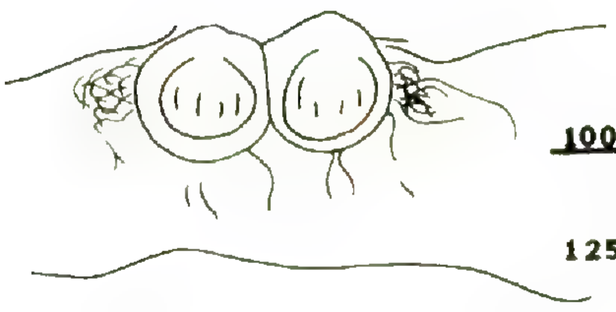
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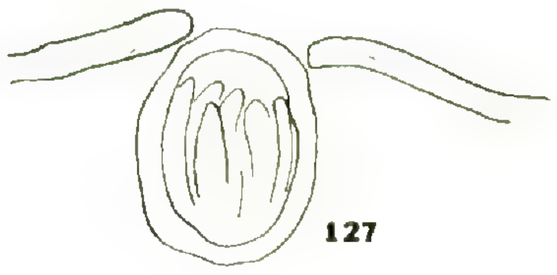
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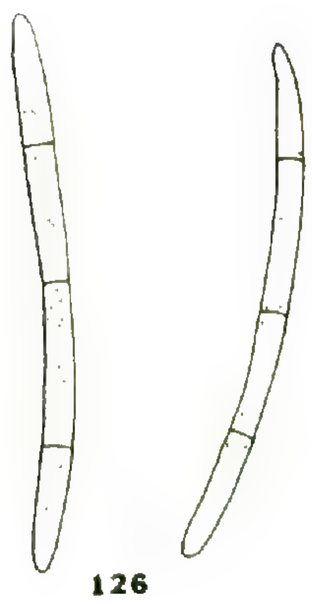
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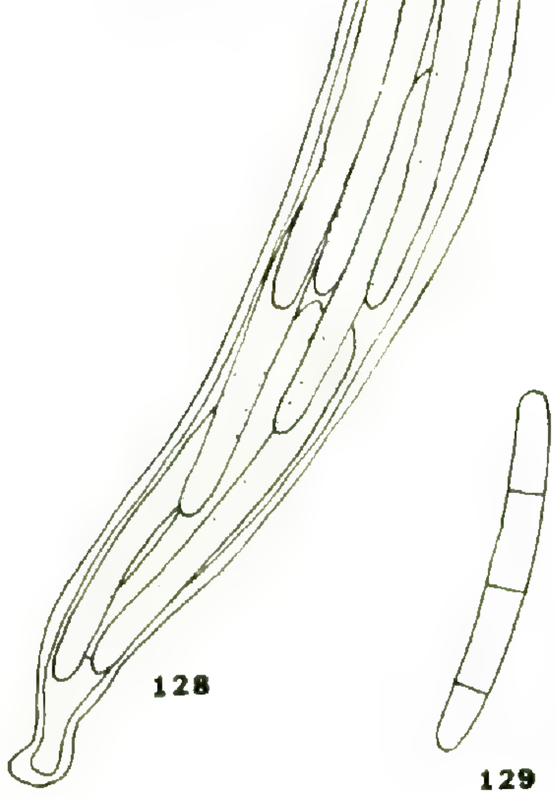
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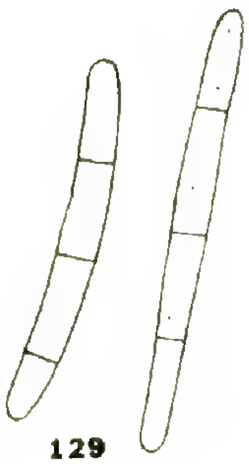
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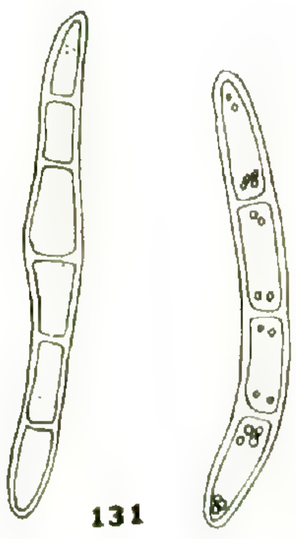
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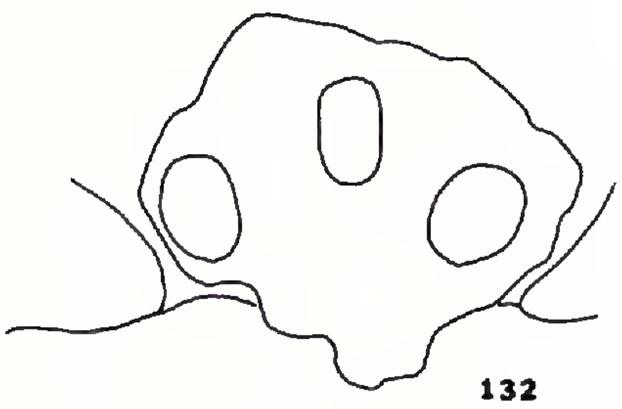
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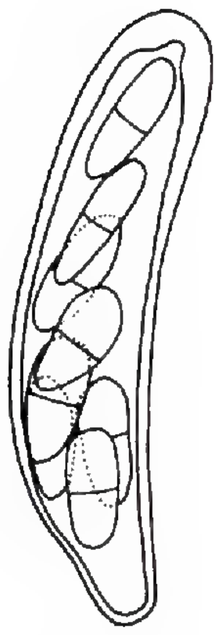
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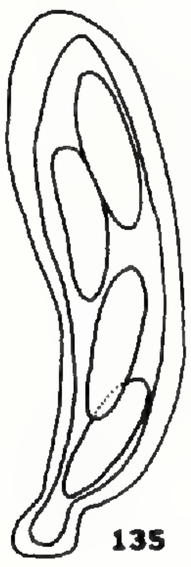
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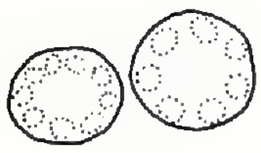
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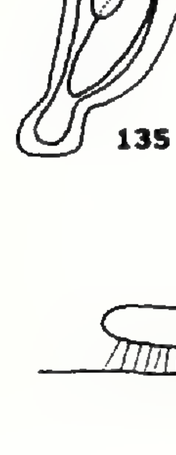
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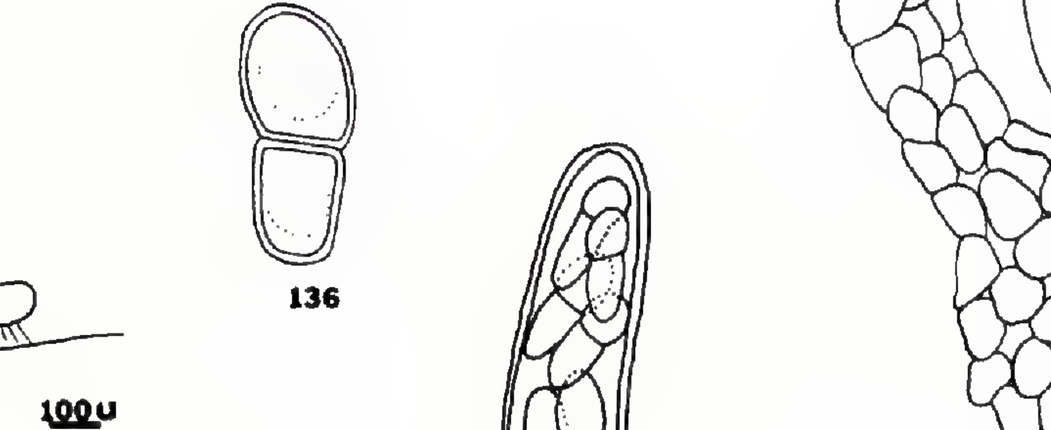
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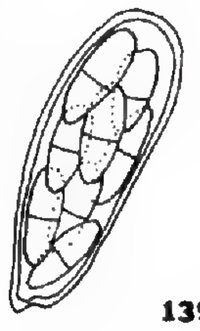
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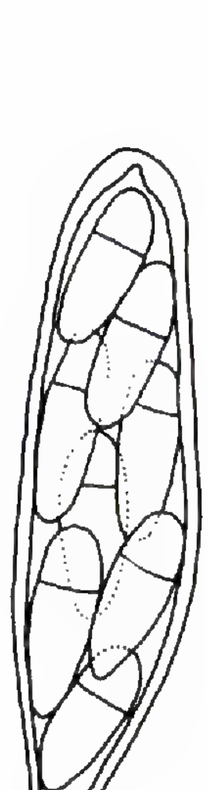
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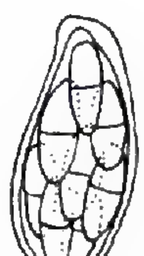

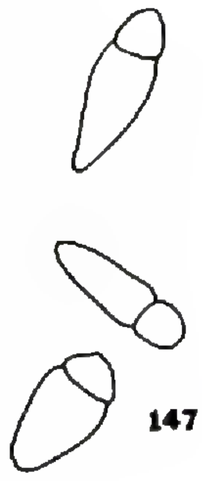
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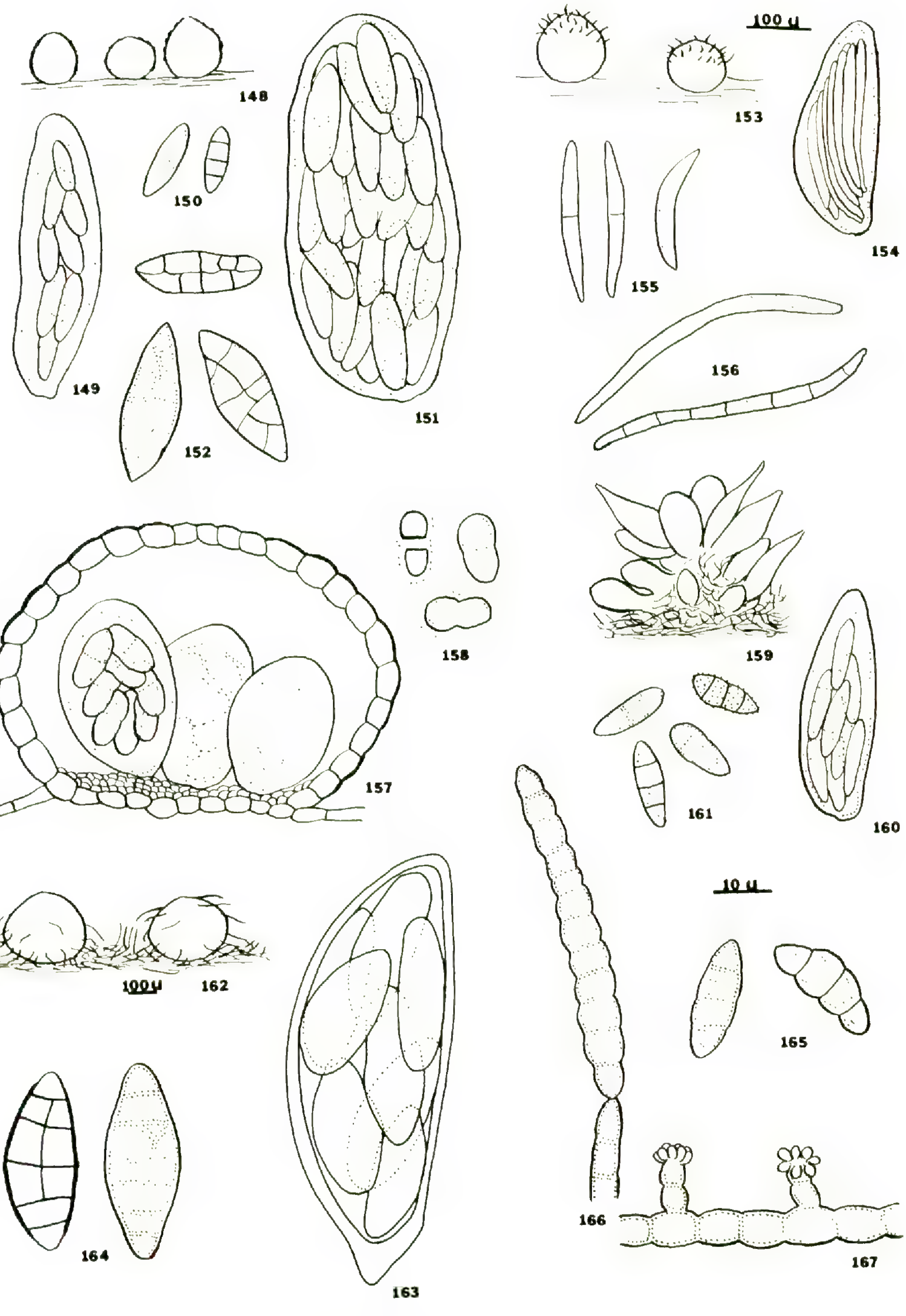

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Errata

p. 224, for Charette, Leopold, read Charette, Leopold A. (1921–1970).
p. 236, lines 4, 6, 7, and 12 from bottom, for Lesègue, read Lasègue.
p. 240, for Gómez y Gutiérrez, Augustín, read Gómez y Gutiérrez, Agustín.
p. [487], line 9, for *S. cordifolius,* read *S. cordifolia.*
p. 517, under **Q. laurina,** line 2, for *chryosphylla* read *chrysophylla.*

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